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BRIEFLY TOLD.

SECRETARY MCKIEGE ON THE STANDARD COMPANY'S RELATION TO THE GAS RATE OF NEW YORK CITY.—With the Managers of the Brooklyn Gas Companies eagerly engaged in a contest for business, which contest involves the invasion of the districts hitherto allotted to the separate companies, and the consequent attempt to divert one another's customers by the offering of a rate lower than the maximum that may be charged under the State laws, it would seem to the ordinary gas consumer either that the Companies had been making too much money or that their managers desired to pose as philanthropists. The ordinary gas manager, however, will be slow to accede to the correctness of either of these propositions, since he knows full well that 28-candle gas supplied in the cities of New York and Brooklyn does not mean an extravagant profit to its suppliers, when sold at the rate of $1.25 per 1,000 cubic feet. As far as the philanthropic suggestion is concerned—well, the least said about that the better; for gas makers, like all other business men, are largely in the trade for the money there is in it. Profit, then, being the main end sought for, it is hard to reconcile that search with the extraordinary procedure of the managers of the Brooklyn gas companies, who are paralleling their neighbor's pipes, and frantically voicing their anxiety to sell gas at 90 cents per 1,000, or at a rate 32 per cent. lower than that which the State deems a reasonable figure. It must not be lost sight of for a moment that the gas consumer of to-day is vastly better acquainted with the cost to the producer of gas of the latter article than he was 20 years ago, at which time the companies might indulge to their heart's content in a merry war, and when the truce was signed cheerily put the rate at the figure that ruled prior to the disturbance. The gas consumer of to-day will not be fooled by any such easy method. He knows what coal, oil, labor, purification materials, etc., cost, and is also pretty well versed in the cost of gas works construction, even to the point of being able to put up a pretty close estimate on the cost of a distributing system; and, knowing all these things, it is pretty safe to say that he will insist on having his gas supply at something like a figure fairly close to its cost. The moral of it all is that people who, through personal pique, foolhardiness or ignorance, seek to temporarily depress trade in any branch, ought to know their ground pretty well, or else take the consequences; and the consequences of this ill-timed, foolish, wretched Brooklyn squabble are sure to be the permanent placing of the gas rate in the cities of New York and Brooklyn at $1 per 1,000 in the very near future. If the Brooklyn snarlers were the only ones to be affected by their acts, no one outside themselves would care a pin, but the worst of it is others who have had no hand in the war must suffer from its effects. Rumor, however, has also been busy with the story that some of the New York city companies were engaged in the game of underselling their neighbors—not in a blatant way; but under the rose. One concern (the New York and East River Gas Company), whose plant is very far from being completed, has been offering prospective consumers gas for $1 per 1,000 cubic feet, on the basis of a three years' contract, and it was also charged that the Standard Company would concede a shilling or more from the legal rate, particularly if the consumer were in the exceptionally eligible class. The same charge was made against the Central Company, and, in fact, the gas rate of the city was covertly threatened all round. In

our last issue reference was made to the situation and its dangers, and that reference has brought out the following from Mr. McKeige, Secretary of the Standard Company. We print his letter with pleasure, and give it all possible prominence, and congratulate him on the fact that his Company is indisposed to assume a marauding position :

THE STANDARD GAS LIGHT COMPANY, OF THE CITY OF NEW YORK,
71 BROADWAY, NEW YORK, July 5, 1894.

To the Editor AMERICAN GAS LIGHT JOURNAL : I wish to correct an impression which certain articles in your paper have made in reference to the cutting of the price of gas by the Standard Gas Light Company. The Standard Gas Light Company has not and is not cutting the price of gas to any of its customers, and it does not intend to do so.

Poor gas and discourteous treatment of customers have more to do with encouraging the formation of new companies than the high price of gas, and until gas companies realize that customers are entitled to consideration they leave the door wide open for competing companies to enter the field.

Yours truly,
F. MCKEIGE,
Secretary.

THE TRADE OUTLOOK.—Our output returns for June compare very favorably with those for the corresponding month of last year; in fact, they show that so far as the gas makers are concerned with hard times, the turning point has been reached. Out of 42 replies received, 29 places show gains, 3 report virtually an even business, and 10 show a slight loss, which in no case exceeds 3.9 per cent. Some of the gains are noteworthy, the maximum being an increase equivalent to 17 per cent., and the lowest gain returned is 4.6 per cent. The grand average increase is 8.5 per cent. All places reporting have the same story to tell in respect of a lively demand for gas cooking apparatus, one Company stating that since May 5th (up to June 27th) it had placed 75 ranges ; and the total population of the place is less than 12,000. Another hopeful sign is the number of Companies that report being engaged in main extension work ; at least 65 per cent. of those answering say that their main mileage is being added to. From the figures given these Companies will in the present summer add something over 400 miles of mains to the total now in operation in the United States. Further reassuring evidence is found in the fact that not only has the total number of meters in use been increased, but that the consumption per meter per month has also been augmented.

MR. JOHN WEST ON WATER GAS FOR ENRICHING PURPOSES.—Mr. John West, who this year presided over the 31st annual general meeting of the Incorporated Gas Institute (the meeting was held at Westminster Town Hall on June 19, 20 and 21), had the following to say in respect of processes for enriching coal gas by means of high candle power water gas, that are now engaging the attention of English gas engineers : "No general remarks upon the manufacture of gas would now be complete without some reference to the subject of enrichment, and the troubles which the adoption of new processes for raising the illuminating power of gas may probably bring. Half a century's experience with cannel coal as an enriching agent has taught us how to use it, and exactly what to expect from its use, and the proportion necessary to give the desired result. Another advantage, which cannot be overestimated, and which is not even yet fully realized, is that, owing to the cannel being mixed with the coal in the retort, the poor gas and the rich cannel gas are evolved together under the same conditions of temperature, with the result that a tolerably uniform quality of gas is put into the holder. Several processes are now being tried upon a large scale, and no doubt engineers have succeeded in so reducing the process of manufacture that the question which some of you will probably have to solve is : Which process will best answer your purpose? At the present time it is difficult to advise you on the matter ; but having had some experience with rich cannel gas mixed with poor coal gas, I shall require some very definite information, obtained from practical working on a large scale, to satisfy me that gases of such extreme densities, when put into a gasholder, become perfectly mixed, and that a certain amount of stratification does not take place."

NOTES.—"Dan." Russell, of St. Louis, knows now how it is to be a father, the original arrival being a bouncing boy, who is said to have turned the scales at 8 pounds. Everybody is happy, and "Dan." has been busy receiving the congratulations of his friends.——The Select and Common Councils, of Philadelphia, have authorized the Director of Public Works to greatly enlarge the distribution system of the city gas works. The increase will amount to something like 50 miles of 6-inch pipe.

[Prepared for the JOURNAL.]

Distribution of Gas.

By MR. J. P. GILL.

Resuming the subject of my paper of Feb. 12th relative to gas, there are several formulas which are useful in estimating the circulation of gas through pipes, which do not appear in print, or at least have not come under the notice of the writer. Having been found to be of value, I communicate them to the JOURNAL for the benefit of those who have an interest therein.

The following formulas have been found to be of practical utility. The quantity given is less than that to be derived from the formulas of Clegg and others, which is advisable, as the pipes are never perfectly straight and clean, being more or less obstructed in curves and by deposits of tar, water and the tappings for services, etc.

$$Q = 1{,}291\ D^{2}\sqrt{\frac{H\,D}{s\,(L+D)}} \quad \text{..... (A)}$$

in which,

Q = quantity in feet per hour.
L = length in yards.
D = diameter in inches.
H = pressure in inches of water at the holder, or the pressure under which the gas enters the pipe.
s = specific gravity of the gas.

Also, let h = pressure in inches at the end of the pipe, or the pressure under which the gas is discharged from the pipe, and f = loss of pressure by friction in the pipes.

The formula (A) gives the quantity discharged by pipes of different lengths, L, in yards. But if the pressure under which the quantity, Q, is discharged is not known, the consequence may be disastrous. For if the pressure should not be sufficient to force the gas through the service pipes, meters, house pipes and burners, the gas, no matter how large it might be in quantity, would be useless, as it could not furnish the amount of light required. It is, therefore, desirable to know the loss of pressure caused by the flow of the gas through the pipe or pipes, and the pressure under which it is discharged at the end of the pipe.

If there is no length of pipe, *i. e.*, if the gas should escape from a circular hole in the holder of the diameter of the pipe, or rather, through a conical adjutage the small diameter of which is that of the pipe, L in the formula becomes 0, and (A) becomes—

$$Q = 1{,}291\ D^{2}\sqrt{\frac{H}{s}} \quad \text{..... (B)}$$

This gives the initial quantity discharged under the full head of the holder.

If we assume Q to be the quantity discharged at the end of the pipe, the open end being of the full diameter of the pipe, formula (B) gives the ***direct*** pressure under which the gas is discharged. Therefore, by substituting h for H, we have—

$$Q = 1{,}291\ D^{2}\sqrt{\frac{h}{s}} \quad \text{..... (C)}$$

By transposing—

$$\sqrt{h} = \frac{\sqrt{s}\,Q}{1{,}291\,D^{2}} \quad \text{..... (D) and—}$$

$$h = \frac{s\,Q^{2}}{(1{,}291)^{2}\,D^{4}} = .0000006\,\frac{sQ^{2}}{D^{4}} \quad \text{..... (E)}$$

$(1{,}291)^{2} = 1{,}666{,}666.6.$

If we take $s = .5$, $h = .0000003\,\frac{Q^{2}}{D^{4}}$ ..... (E′)

Since the quantity discharged is greater as the length of the pipe is less, h will also be greater and in proportion to the square of Q.

In equation (E) it will be noticed that both the factors L and H are absent. Now—

$$f = H - h \quad \text{..... (F)}$$

which gives the loss of pressure by friction.

When the quantity, Q, has been estimated, the pressure at the end of the pipe under which it is discharged and the loss by friction may be found by equations (E) and (F). The square of Q in (E) gives h, and h in (F) gives f.

There are two equations, by which h and f may be found, which are more direct and more simple than (E) and (F). Since Q represents the same quantity in equations (A) and (C) it is evident that—

$$h = \frac{H\,D}{L+D} \quad \text{..... (G)}$$

and since f equals $H - h$,

$$f = H - \frac{HD}{L+D} = \frac{HL+HD-HD}{L+D} = \frac{HL}{L+D} \ldots\ldots\ldots \text{(H)}$$

By transposition equation (G) becomes—

$\frac{h}{D} = \frac{H}{L+D}$, and by substituting in (H) we have—

$$f = \frac{hL}{D} \ldots\ldots\ldots \text{(I) and—}$$

$$h = \frac{fD}{L} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(I')}$$

Equation (I) gives $f = \frac{hL}{D}$, and equation (E) gives $h = .0000006\frac{sQ^2}{D^5}$. Substituting the right hand member of equation (E) for h in equation (I) there is obtained the following value for f:

$$f = .0000006\frac{sLQ^2}{D^5} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(J)}$$

Also, from equation (A) we obtain $Q^2 = (1,291)^2\frac{D^5H}{s(L+D)} = 1,666,666.6 \times \frac{D^5H}{s(L+D)}$, hence—

$$H = \frac{s(L+D)Q^2}{1,666,666.6\,D^5} = .0000006\frac{s(L+D)Q^2}{D^5} \ldots\ldots\ldots\ldots \text{(K)}$$

$$H - h = f = .0000006\frac{s(L+D)Q^2}{D^5} - .0000006\frac{sQ^2D}{D^5} = .0000006\frac{sLQ^2}{D^5},$$

the same as equation (J). The value of h in the above equation is obtained from equation (E).

The equation giving the value of f $\left(f = .0000006\frac{sLQ^2}{D^5}\right)$ may be deduced from Clegg's formula, $p' = m\,l\,\frac{c}{a}\,S\,v^2$, as follows:

l = length in feet.
c = circumference of pipe in feet.
a = area of pipe in feet.
S = weight per cubic foot of the fluid in pounds.
v = velocity in feet per second.
d = diameter in feet.
m = coefficient of friction = .00011.

Now, $\frac{c}{a} = \frac{d}{4}$, and $p' = \frac{62.4h'}{12} = 5.2\,h'$, h' being the pressure lost in inches of water, and $S = .0807\,s$, s being the specific gravity of the gas. But $Q = \left(\frac{d}{2}\right)^2 3.1416\,v$, and $v^2 = \frac{Q^2}{(.7854)^2 d^4}$

Let l be in yards and d be in inches and Q be in feet per hour. By substituting and reducing, there results

$$f = m\ .0054\frac{l\,s\,Q^2}{d^5} = .0000006\frac{l\,s\,Q^2}{d^5}$$

and by putting capitals in place of the small letters,

$$f = .0000006\frac{sLQ^2}{D^5}, \text{ the same as equation (J).}$$

In equations (G), (H) and (I) the friction and terminal pressure are obtained without considering the specific gravity of the fluid. These formulas are true for gas, air and water, and indicate that the friction is involved in the pressure, the pressure being a function of the specific gravity; because Q and L being constant, any variation resulting from a change in the specific gravity is compensated by an inverse change in H.

For convenience of reference the preceding formulas will now be grouped together:

(A). $Q = 1,291\,D^2\sqrt{\frac{HD}{s(L+D)}}$ gives the quantity discharged at the end of the length, L.

(B). $Q = 1,291\,D^2\sqrt{\frac{H}{s}}$ gives the initial quantity discharged by an opening in the holder with diameter D, with the pressure H.

(C). $Q = 1,291\,D^2\sqrt{\frac{h}{s}}$ gives the quantity discharged by the pipe under the terminal pressure h.

(D) $\sqrt{h} = \frac{\sqrt{s}\,Q}{1,291\,D^2}$

(E) $h = \frac{sQ^2}{(1,291)^2\,D^4} = .0000006\frac{sQ^2}{D^4}$, gives the pressure at the end of the pipe.

(E') $h = .0000003\frac{Q^2}{D^4}$, in which $s = .5$.

(F) $f = H - h$, gives the loss of pressure by friction in the pipe.

(G) $h = \frac{HD}{L+D}$, gives the pressure at end of pipe.

(H) $f = \frac{HL}{L+D}$, gives the loss of pressure by friction.

(I) $f = \frac{hL}{D}$, gives the loss of pressure by friction.

(I') $h = \frac{fD}{L}$, gives the pressure at end of pipe.

These formulas (G), (H), (I), (I'), are only applicable to an unobstructed pipe, of full size, from which the gas passes freely.

(J) $f = .0000006\frac{sLQ^2}{D^5}$, this formula is applicable also to the cases where the quantity of gas discharged is less than that which the pipe through which it has passed is capable of discharging.

(K) $H = .0000006\frac{s(L+D)Q^2}{D^5}$, gives the pressure at the holder when Q is known.

The following are examples in illustration of the above formulas.

Example 1.—Let $D = 10$ inches, $L = 400$ yards, $H = 2$ inches, what will Q, h and f be?

By equation (A), $Q = 1,291\,D^2\sqrt{\frac{HD}{s(L+D)}}$

Making $s = .5$, which is a convenient and average quantity and substituting, there results, since $\sqrt{.5} = .707107$.

$Q = 1,825.75\,D^2\sqrt{\frac{HD}{L+D}} = 1,825.75 \times 10^2\sqrt{\frac{2\times10}{400+10}} = 40,324$ cubic feet per hour.

Equation (G) gives $h = \frac{HD}{L+D} = \frac{2\times10}{400+10} = .0487805$ inches.

Equation (E) gives h $.0000003\frac{Q^2}{D^4} = .0000003 \times \frac{(40,324-)^2}{10,000} = .0487805$ inches as above.

(H) gives $f = \frac{HL}{L+D} = \frac{2\times400}{400+10} = 1.9512195$ inches.

(I) gives $f = \frac{hL}{D} = \frac{.0487805\times400}{10} = 1.9512195$ inches.

(F) gives $f = H - h = 2 - .0487805 = 1.9512195$ inches.

(J) gives $f = .0000003\frac{LQ^2}{D^5} = 1.9512195$ inches.

Example 2.—Let the length of the 10-inch pipe be 1,800 yards.

By formula (A) it will discharge 19,105 cubic feet, and

h will be $= \frac{HD}{L+D} = .01104972$ inches = about $\frac{1}{90}$ of an inch pressure; and

$f = \frac{LH}{L+D} = \frac{1,800\times2}{1,800+10} = 1.98895$; also,

$f = 2 - .01105 = 1.98895$.

Proof by formula (C): $Q = 1,825.75 \times 100\sqrt{.01105} = 1,825.75 \times 100 \times .104642 = 19,105$ cubic feet as above.

The pressure H is nearly all lost by friction in the pipe, and h, being only $\frac{1}{90}$ of an inch, is too small to supply the gas to the burners, and there will be little or no light.

Example 3.—Suppose the quantity used is only 17,000 cubic feet at the end of the 10-inch pipe. At what pressure will it be delivered?

By formula (J) we have, with $s = .5$

$f = .0000003\frac{LQ^2}{D^5} = .0000003\frac{1,800\times(17,000)^2}{100,000} = 1.5606$; and

$h = H - 1.5606 = .4394$ of an inch, which is too light a pressure to send the gas through the services, meters and pipes to the burners with sufficient force to give a good light.

Example 4.—How much gas can be discharged from the end of a 10-inch pipe, 1,800 yards long, to let the pressure h at the point of discharge be 1 inch?

$H - h = 2 - 1 = 1$ inch $= f$, and formula (J) gives

$1 = .0000003\frac{1,800\,Q^2}{100,000}$, and by transposition

$Q^2 = \frac{100,000}{.0000003\times1,800} = 185,185,185$, and

$Q = 13,608$ cubic feet, which is about 71 per cent. of the quantity the pipe will discharge when the gas passes freely.

It is evident that a pipe should be somewhat larger than that which would be sufficient to discharge just the quantity of gas required for use.

The above formulas, with the exception of (J), are based on the hypothesis that the pipe is of uniform diameter throughout its entire length and open at the end. These may be called foundation formulas.

Where the discharge of gas is obstructed—*i. e.*, where it is discharged through a pipe or opening which has a smaller diameter than that of the pipe through which it has passed; or, in other words, where the quantity of gas discharged is less than that which the pipe through which it has passed is capable of discharging, other formulas for estimating the quantity discharged are required.

This is an important problem and is somewhat difficult of solution owing to the variable character of the quantities involved. The formula given below will furnish a solution of a practical character with but little trouble. To obtain this requires the use of Algebraic unknown quantities, but, of course, the formula itself will be free from them.

Let there be a pipe of any diameter, D, of any length, L, and at the end of the pipe an opening or very short piece of pipe of a smaller diameter, d. What will be the quantity, q, of the gas discharged through the opening or pipe with the diameter, d, with a pressure, h, at the end of the larger pipe, so that h will produce the discharge of the quantity, q, and at the same time be that pressure produced by the passage of the quantity, q, through the larger pipe.

Formula (C) gives $q = 1{,}291\ d^2 \sqrt{\frac{h}{s}}$

and formula (J) gives $f = H - h = .0000006 \frac{s\ L\ q^2}{D^5}$

Let $q = x$ and $h = y$ and we have

$$x = 1{,}291\ d^2 \sqrt{\frac{y}{s}} = \frac{1{,}291}{\sqrt{s}} d^2 \sqrt{y} \quad \text{..... (M)}$$

$$H - y = f = .0000006 \frac{s\ L\ x^2}{D^5} \quad \text{..... (N)}$$

from (N) by transposition we obtain

$$y = H - \left(\frac{.0000006\ s\ L\ x^2}{D^5}\right) \quad \text{..... (O)}$$

By substituting this value of y in (M), we have

$$x = \frac{1{,}291}{\sqrt{s}} d^2 \sqrt{H - \left(\frac{.0000006\ s\ L\ x^2}{D^5}\right)}$$

and squaring

$$x^2 = \frac{(1{,}291)^2}{s} d^4 \left[H - \left(\frac{.0000006\ s\ L\ x^2}{D^5}\right)\right]$$

and putting $n = (1{,}291)^2 = 1{,}666{,}666.6$ and $m = .0000006$,

$$x^2 = \frac{n}{s} d^4 \left[H - \left(\frac{m\ s\ L\ x^2}{D^5}\right)\right]$$

$$x^2 = \frac{n}{s} d^4 \left(\frac{H\ D^5 - m\ s\ L\ x^2}{D^5}\right)$$

$$x^2\ D^5 = \frac{n}{s} d^4\ (H\ D^5 - m\ s\ L\ x^2) = \frac{n}{s} H\ d^4\ D^5 - \frac{n}{s} m\ s\ L\ d^4\ x^2$$

$$x^2\ (D^5 + n\ m\ L\ d^4) = \frac{n}{s} H\ d^4\ D^5$$

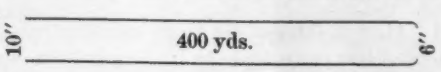
now $n\ m = 1{,}666{,}666.6 \times .0000006 = 1$, making the proper substitutions of the arithmetical values,

$$x^2 (D^5 + L\ d^4) = \frac{1{,}666{,}666.6}{s} H\ d^4\ D^5 \quad \text{..... (P)}$$

(P) is the general equation for the solution of the problem. Let $s = .5$

$$x^2\ (D^5 + L\ d^4) = 3{,}333{,}333.3\ H\ d^4\ D^5 = q^2\ (D^5 + L\ d^4) \text{.. (P')}$$

Example 5.—Let the larger pipe have the diameter $D = 10$ in., its length $L = 400$ yards, the diameter of the smaller pipe or opening $d = 6$ inches. What will be the quantity q, and what will be the pressure h, at the end of the 10 in. pipe, so that it will cause the discharge of q through the 6 inch opening, and will also be that pressure caused by the passage of q through the 10 in. pipe?



Suppose, in the first instance, that gas should pass through the 10 inch pipe freely; a certain quantity would be discharged with a pressure h at the end of the pipe. Now, suppose the end to be reduced to 6 inches diameter; a less quantity of gas will then be discharged with the pressure h. But a less quantity of gas passing through the 10 inch pipe, there will be less loss of pressure by friction, and consequently h will become greater, and as a consequence of that increased pressure q, will be increased; h will then be diminished, there being more friction in the 10 inch pipe, and this diminution of the pressure will cause q to become proportionally less; there will in this manner continue to be a temporary oscillation until at last a point is arrived at, at which q and h will equate with each other, and there will be no further oscillation. The problem is to determine that point.

Let $H = 2$ inches. By substituting their numerical values for D, L, d and H in equation (P') we get—

$x^2\ (10^5 + 400 \times 6^4) = 3{,}333{,}333.3 \times 2 \times 6^4 \times 10^5$, and
$x^2\ 618{,}400 = 864{,}000{,}000{,}000{,}000$,
$x^2 = 1{,}397{,}153{,}945$,
$x = 37{,}378 = q$.

By equation (O), and substituting the value of x in it, $y = 2 - \left(\frac{.0000003 \times 400 \times 1{,}397{,}153{,}945}{100{,}000}\right) = 2 - 1.67658 = .32342 = h$.

Proof: Formula (C) gives—

$q = 1{,}825.75\ d^2\ \sqrt{h}$, where $h = .32342$, and $d = 6$; hence,
$q = 1{,}825.75 \times 36 \times .5687 = 37{,}378$, the same quantity as above.

By formula (P') we are prepared to prove Example 4. In that example a 10-inch pipe, capable of discharging 19,236 cubic feet, only discharges 13,608 cubic feet with a pressure h at end of the pipe; 13,608 cubic feet with a 1-inch initial pressure will be discharged by a pipe with a diameter of 2.73 inches; for $q = 1{,}826\ d^2\ \sqrt{h}$, and $d^2 = \frac{q}{1{,}826\ \sqrt{h}} = \frac{13{,}608}{1{,}826} = 7.4524$ —, and $d = \sqrt{7.4524} = 2.73$, $d^4 = 55.545$.

(P') gives $x^2\ (D^5 + L\ d^4) = 3{,}333{,}333.3\ H\ d^4\ D^5$, therefore,
$x^2\ (100{,}000 + 1{,}800 \times 55.545+) = 3{,}333{,}333.3 \times 2 \times 55.545 \times 100{,}000$.
$x^2\ 1.99982 = 37{,}030{,}000{,}000{,}000$.
$x^2 = 185{,}166{,}665$.
$x = 13{,}608 = q$, as above.

By equation (O), with $s = .5$:

$$h = 2 - \left(\frac{.0000003 \times 1{,}800 \times 185{,}166{,}665}{100{,}000}\right) = 2 - 1 = 1 \ldots . \text{Q.E.D.}$$

If s is some other number than .5, equation (P) would have to be used.

[To be concluded.]

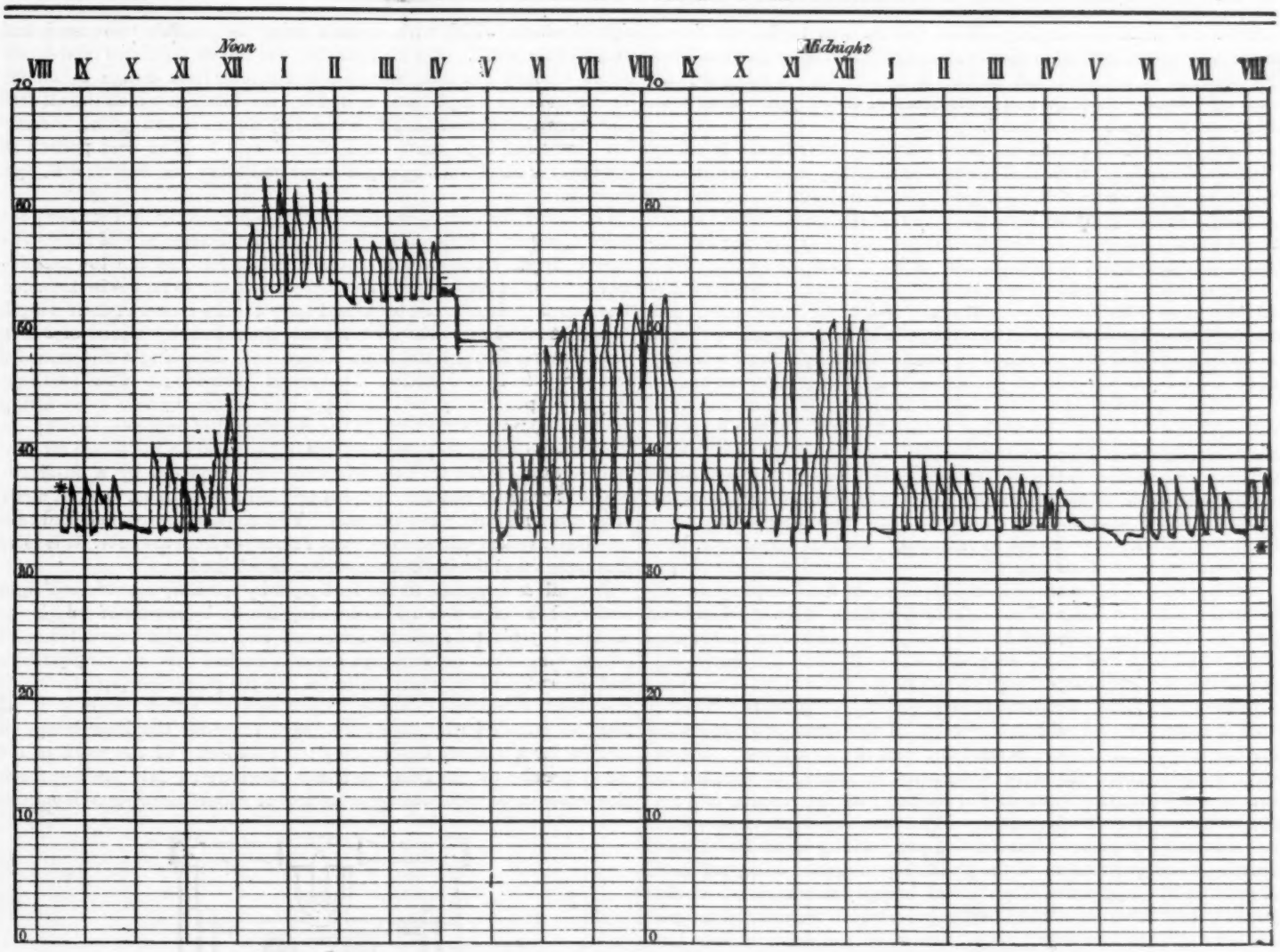
[Prepared for the JOURNAL.]

An Offering for the Heated Term.

By an "OLD CONTRIBUTOR."

A number of years ago, when in charge of a coal gas works where water gas had been recently introduced, and both kinds were made for a time, I noticed that the pressure indicator in the exhauster room gave certain, though only a slight, evidence every time a run of water gas was made in the latter department. Having recently taken charge of another works, I found that water gas was made in a double set of the Granger type of apparatus, erected a dozen years before by the writer, and, that although the results obtained were quite good, we could not understand why a set of the so-called "Improved Lowe Water Gas Apparatus," erected only last summer, was standing idle. Naturally, one would suppose that the "improved" method would have been preferred to the older one. Upon inquiry we learned that the reason why the new machine was not used was because it had proved extravagant in oil, and had produced bad, smoky gas, etc., etc. Having had no personal experience with the method mentioned, we still did not believe the story about its imperfections, and quietly proceeded to investigate; and this is what we found: The top of the oil feed tank was connected with the foul gas main, so "As to always have gas pressure on the oil." But it happened sometimes that the glass gauge on this tank would get stopped up; in fact, it often happened. Then the gas maker would not be able to see how much oil he had when pumping up, and hence we do not know, and can only surmise, how many thousands of gallons of oil had been pumped overboard into a convenient creek, before the advent of the writer, without discovery.

We also found that the printed directions accompanying the "Improved Lowe" called for six to eight minute "blows" and ten minute "runs," whereas with the Granger fifteen minute runs had been made. It was easy to see that with the former apparatus the gas maker had to move about a bit more than with the other. The usual "station card," upon which the gas maker kept his record of work done (which was turned over to the superintendent every morning), seemed to point out that the instructions previously referred to were carried out with remarkable regularity; they were, in fact, too regular by half, in my opinion. While present, the work was done as it ought to have been, but one could not be there all the time; hence, we remembered the performance of the pressure indicator mentioned at the beginning of this article, and were so fortunate as to be able to persuade the president to get one for us, which, on arrival, was set with the results expected. We found that 15 and 20-minute runs were made, and not runs of the duration required. When we had the evidence in hand, we asked the gas maker about his reports, produced our evidence, and



Pressure Indicator Diagram from Inlet to Relief Holder of Water Gas Generator.

Average gas made per run, 4,375 cubic feet. From about 4:30 P.M. to 4:30 P.M. next day.

took him completely by surprise. Now, we have no trouble; if we were to tell that gas maker to make 2½-minute runs, or any other thing, he could be relied upon to do it. He does not know but we have some other little secret tell-tale arrangement elsewhere; and maybe we have. Still, as he is really a most excellent gas maker, we let it go at that. Inclosed is one of our indicator sheets, which you can publish if you wish. It represents a run of 24 hours.

In explanation of the diagram we would say that the high points represent the runs made. From eight o'clock until noon the relief holder was worked uncupped; about 12:20 P. M. the holder cupped. From 6 to 9, and again from 10:30 P.M. to midnight, the diagram shows that the inlet drip to relief holder was not freed, as it ought to have been. In six places, where the points are far apart, are shown the times when the fires were cleaned, and at two places the wide hiatus would indicate that the gas maker probably supposed he had done enough and took a rest. Shortly after introducing these few and simple reforms we found that the new apparatus had been badly slandered and that we could get as good results from it as anybody else. It was also found that, working according to instructions, we stopped making naphthaline, which previously had been produced plentifully. As the thermometer at our works, which is hung in the coolest spot we can find, registers, at 5 P.M., 100°, we may be more than excused if we cut this article short without further apologies.

The Introduction, Development, and Practical Working of the Oxy-Oil Gas Process at the Huddersfield Gas Works.

[A paper read by Mr. W. R. Herring before the Incorporated Institution of Gas Engineers.]

The subject of gas enrichment, a particular branch of which the author has the honor of bringing under the notice of this Institution, is one of such considerable interest and far-reaching importance, that he feels an apology is due to the members for the incomplete nature of the matter he is able to place before them; but, owing to his engagement upon an extensive reconstruction of works scheme, circumstances have been such as to prevent more time being spent upon experimental and research work than was sufficient to ensure the successful practical working of what may be termed a new departure in gas-enriching processes. This has become generally known as the "oxy-oil process," and it consists essentially in the admixture of definite percentages of free oxygen with the resulting heavy hydrocarbon gases produced by retorting crude or heavy grade oils at a low temperature—the admixture being made when the oil gas is still hot, by which means a considerable quantity of heavy hydrocarbon vapors are sustained in a permanently gaseous state, which otherwise would condense and be lost as illuminating agents.

This process was first brought under the notice of gas engineers by Dr. Thorne, in a paper published by the Gas Institute in 1890. Early in 1891, the attention of the Huddersfield Gas Committee was drawn to the process by the patentee and the English representative of the syndicate owning the patents, who had erected an experimental plant at a doctor's house in Huddersfield, where the patentee demonstrated, in the presence of the late Engineer of the Corporation, the practicability of producing a mixture of two such gases without danger, and, as far as could be seen, with considerable advantage from a gas manufacturer's point of view. The Gas Committee were invited to inspect the plant, and they were so much impressed by the demonstration, that it was resolved to give the process a practical trial, on a moderate scale of working, at the Huddersfield Gas Works, with a view of employing the gas as an enriching agent in lieu of cannel.

With this object in view, negotiations were entered into with the Northern Counties Company's agents, with a view of settling terms upon which a license for the use of the patents might be arranged. These negotiations were very much protracted, from various causes, and they were not finally signed until April 6, 1892. It was about a month previous to this date that the author was appointed to take charge of the Huddersfield Gas Works, and he then, for the first time,

learned that plant for carrying out the process was to be put down. He was, however, unable to discover any information or particulars at the works as to the form the plant was to take for retorting the oils, although detail drawings and particulars of the oxygen plant were there, and the work was in hand.

During May, 1892, a communication was received from the Northern Counties Company, in which it was stated that they were prepared to exhibit the production of oxy-oil gas upon a manufacturing scale of working; and they invited the author to visit their Great Malborough Street works in Manchester to inspect the plant, and make any investigation he might think fit. On the 26th of May, 1892, the author visited the experimental works in Manchester, and he was disappointed to find the plant to be on a very small scale, and, as far as the actual producing portion was concerned, of a very crude form indeed—so much so, in fact, that he was compelled to condemn it for practical working, as he did not consider himself justified in multiplying it for the scale of working it was intended to carry out at Huddersfield. The results of the experiments which the author obtained with this plant, however, gave very great promise of success; but there is always such a wide gulf between results obtained by experiments of this nature (what with short runs and clean apparatus, etc.), and the results of the same when subjected to practical working conditions, that the author's report upon his investigations was drawn in extremely cautious terms, not, however, without hope of ultimate success.

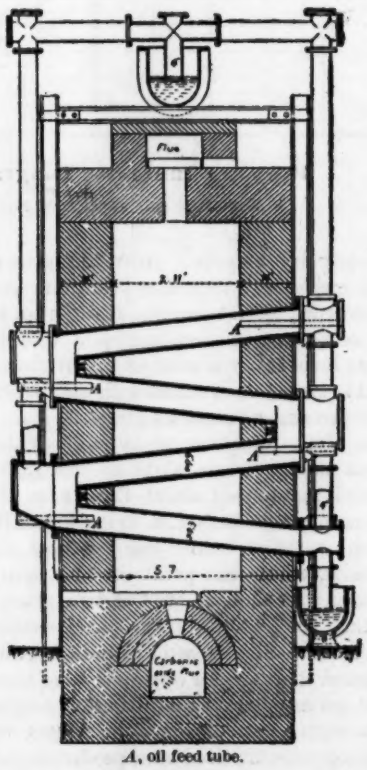
During July of the same year, the Manager of the Company submitted to the author a design of an entirely new form of retort which had been provisionally protected by the Company, and shown on diagram No. 1. This appeared to possess points of novelty, and the author suggested that a retort of this design should be put down at the Manchester experimental works. This was done as quickly as possible. Another visit of inspection was paid in November of the same year, and some further investigations were carried out with the new retort. The results obtained therewith were sufficiently promising to warrant the author in advising his Committee to proceed with the erection of a portion of the plant at Huddersfield. With this object in view, a letter was sent to the Northern Counties Company asking them for detailed drawings and particulars of the plant they suggested being put down to produce the oxygenated oil gas; and, in reply thereto, a set of blue prints were received from the Company, on which were shown the general arrangement and details of the plant to be put down at Huddersfield for the production of 200,000 cubic feet per diem.

The author did not consider it wise to adopt the arrangements shown on these prints, for reasons which many will appreciate upon examining them. He was not, however, prepared to take all the responsibility upon himself for the success or the failure of the process; so, after due consideration, it was determined to adopt the form of retort which the Company had patented, and make other arrangements as regards the general design of the whole plant. This resulted in the arrangement shown on diagram No. 2. It was decided to erect the bench in one corner of a retort house, beneath an overhead stage, intended at some time to be used for the delivery of coal into the retort house; but as there was no possibility of such being the case, it was felt that this position was most convenient, as all apparatus—such as condenser, exhauster, etc.—could be erected upon this stage out of the way of the ordinary retort house operations.

The design, briefly described, consists of three arches of brickwork, 7 feet 9 inches by 8 feet high, and 5 feet 3 inches from the front to the back. At one end a simple generator furnace was provided, with a carbonic oxide gas flue passing underneath the three settings, with dampers arranged so that any one or all three of the settings might be worked together. The exit flue is on the top of the bench, there being two dampers to each setting. One of these settings was first equipped with six retorts of the design shown on diagram No. 1, with ascension pipes back and front, together with an ordinary hydraulic main and dip pipes. The plant was finished in June, 1893, and put to work after the customary delays inseparable from starting any new process. To be brief, however, it must be admitted that the setting was a failure, although it was not recognized as such until some weeks of fruitless endeavor had been devoted to attempting to make it work successfully and continuously. During these many trials, however, some valuable information was obtained as to the principles of the process itself, which were certainly encouraging, and justified the author in determining to try again. The chief cause of the failure was owing to the form of retorts used not permitting of expansion without springing some or other of the many joints, which consequently allowed gas or oil to escape outwardly, or the admission of air to the gas produced. The failure of the first setting resulted in the production of an entirely different design of retorts, which with as little delay as possible were made and prepared for work. On diagram No. 3 is shown the detail of the new retort, made of cast iron, 6 feet six inches long from flange to flange. The front has a flange cover bolted thereto, through which the oil feed pipe passes, and to which it is secured by means of luting and a cross-bar, screw and lugs, shown at A, figs. 1 and 2. The back portion of the retort is fitted with a hinged cover and screw, as shown at B, figs. 3 and 4.

The retorts are arranged in groups of 15 per setting, in four tiers, the three upper rows being of four each, and the bottom row of three. The twelve upper retorts are 8 inches in diameter, and the lower three, which are used for cracking the heavy residuals, 10 inches in diameter. The retorts incline to the back, and have 3 feet 9 inches of their length exposed to the heat. The oil is fed into the retorts by means of 2-inch tubes passing through the front covers and extending a distance of 3 feet along the heated portion of the retort. This length of the feed tube is split longitudinally, and the upper half secured by two loose fitting collars. The tubes are fixed in the retorts in the manner already described, and when they require cleaning a union on the ¼-inch oil pipe is disconnected, and the tube withdrawn and replaced by a duplicate, which is put into position, coupled up, and the retort set to work again after standing only a few minutes. The collars from the choked tube are then knocked off, and the carbon removed from the tube. It is from this source that the bulk of the carbon is obtained.

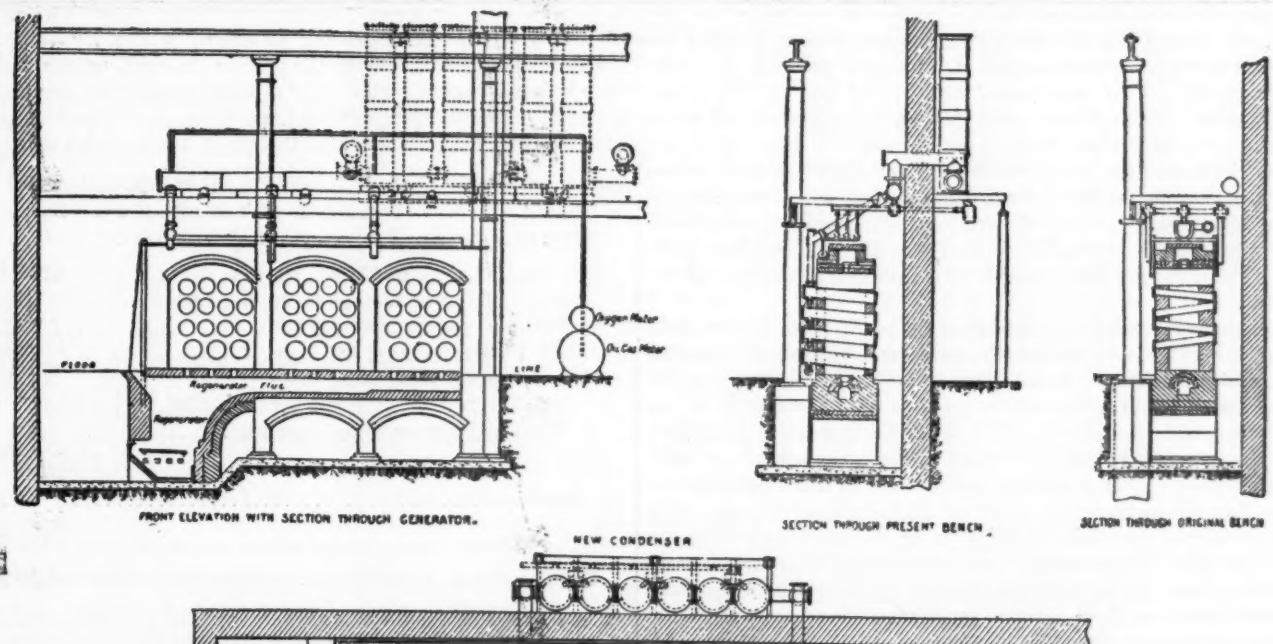
The oil is supplied to the feed pipes by specially constructed sight feed syphons (figs. 5 and 6 on drawing No. 3), by means of which the oil flow is protected from draughts and dust and also prevented from overflowing when the feed pipe becomes choked; the oil simply rising and filling the glass, which indicates that the particular pipe to which it is attached requires cleaning. Each row of retorts can be shut off from the remainder by means of a valve, to enable the interchange of oil feed tubes without interrupting the continuity of the work of the whole bench; the gas from each row discharging into one ascension pipe common to each setting, at the top of which the oxygen is admitted. The admission of oxygen is proportioned by a specially constructed meter, coupled by means of chain and wheel gear to, and consequently governed by, the oxy-oil station meter, the proportion of oxygen admitted being adjusted to any definite percentage by means of change wheels. The author has found 15 per cent. to be the most suitable for the production of an enriching gas with the class of oil he is now using, of .878 sp. gr.



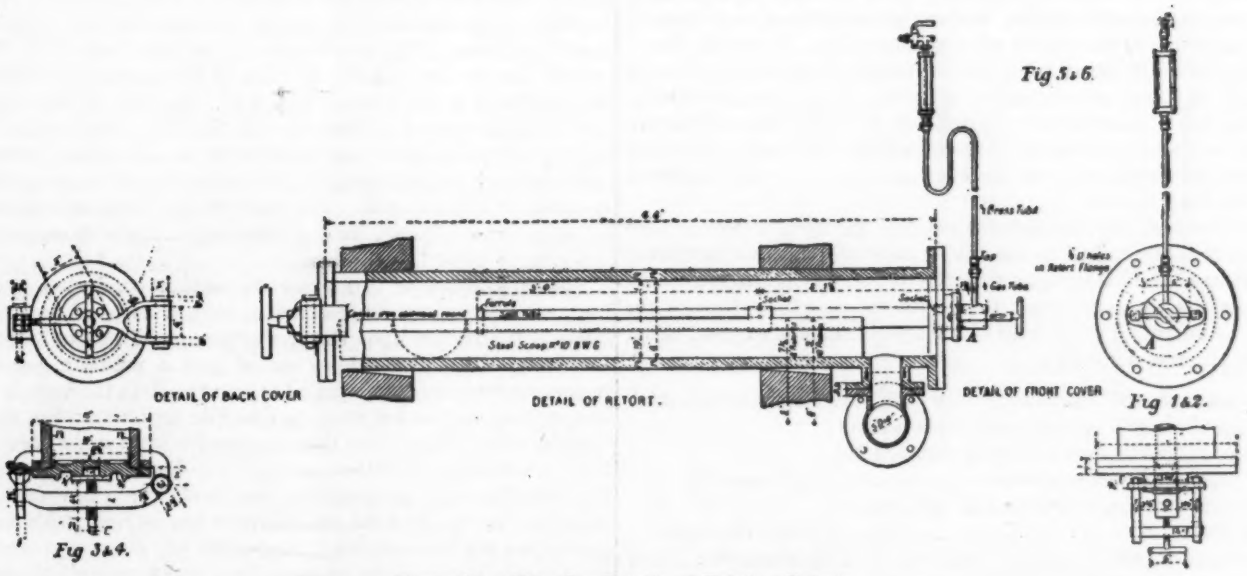
A, oil feed tube.

Drawing No. 1.—Details of First Installation.

The collective arrangements of oil feeding to the various rows of retorts are as follows: The two upper rows in each bay are fed with fresh oil in such quantity (depending upon the heat, which should be maintained at a dull red) as to yield a canary colored gas. The third



Drawing No. 2.--General Arrangement of Oxy-Oil Gas Plant.



Drawing No. 3.--Details of Existing Retort.

row is supplied automatically with the light oils from the condenser, supplemented by fresh oil. The bottom row is fed with the heavy oils and tar collected in the sealcups of the ascension pipes, which is conducted automatically to a tank on a lower level and pumped into a feed tank on the stage.

The gas immediately on leaving the retorts passes up the one ascension pipe common to each setting, where it discharges into a collecting main, from which it is conducted to the condenser inlet; the condenser being fixed level with the upper stage, but on the outside of the retort house wall. After condensation, the gas passes through the meter direct. When the admixture is being made in the foul main, or when enriching at the meter inlet, it passes first through the exhauster and then through the meter.

When originally designing the general arrangement of the plant, the author made provision to admit the enriching gas either at the foul main or by working a small exhauster, and passing the gas through a small weighted holder. The admixture could be made at the inlet of the station meter—a point which theoretically appears to be the correct one, though practically the advantages do not compensate for the additional trouble involved in working an exhauster when a small plant is in question.

Having briefly described the general arrangement of the plant, there yet remains to be dealt with the all important question of results. But before proceeding to supply these, it may be advisable to give a brief description of the capacity of the plant at present existing at Huddersfield. As already stated, the oil plant consists of three bays or settings, each of 15 retorts; each setting being capable of cracking one ton of oil per diem, which is equal to an average yield of about 85,000 cubic feet of gas daily. The plant is attached to the No. 3 section of the works, which is equal to a total output of 2,500,000 cubic feet per day. It is, therefore, possible to admit 3.4 per cent. of the oxy-oil gas to the total production on this section of the works. As a matter of fact, about 2½ per cent. is now being admitted; and for the immediate future, and until greater progress has been made with the general reconstruction of the works, this quantity will be maintained. This will, therefore, leave a margin of 26 per cent. to work upon.

In connection with the new retort house now in course of construction, a complete oxy-oil gas works is also being arranged, of such proportion as to allow of the present requirements being met, together with provision for future extension. At one time it was intended to supply a 20-candle gas, but so much satisfaction has been expressed with the 18½-candle gas which has been supplied for some time past, both as re-

gards cleanliness and lighting effect, that it seems useless to raise the illuminating power to a higher standard. There is no doubt that 18¼-candle gas produced by enrichment with oxy-oil gas gives a much greater apparent lighting effect than a gas of equal photometrical value produced by enriching with either oil gas or cannel. The oxy-oil enriched gas yields a steady, rigid, and white flame. This fact has, therefore, resulted in a modification of the original idea, which was to produce a sufficient quantity of oxy-oil gas to admit 5 per cent. to the maximum make of from 3¾ to 4 million cubic feet a day, and produce a 20-candle gas. For the present, however, it is intended to supply an 18¼ candle gas.

With regard to the practical working of the plant; there is very little trouble indeed, so far as difficulties are concerned, excepting when the heats are allowed to get too high. The whole secret of successfully making gas from liquid hydrocarbons depends upon the degree of the heat applied, combined with its method of application; and the author's experience is that a comparatively slight increase or decrease of heat makes a difference in the quantity and quality of the resulting products out of all proportion with the extent of the change of heat. It is, however, worthy of note that the result in candle feet yielded per ton of oil used remains fairly constant, notwithstanding the variations of heat, provided these are not allowed to range too far. Under ordinary conditions of working, there is not so much trouble as many experience with stopped ascension pipes.

The process has been in continuous work at Huddersfield for the past eight months, and a total quantity of upwards of 3,500,000 cubic feet of gas has been made and employed as an enriching agent during this period—entirely supplanting cannel upon the No. 3 section of the works. In order to give a fair statement of the results obtained during the past winter, it will be necessary to leave out of consideration the period up to the beginning of December last, as, owing to the coal strike, the supply of coal was partially from Durham and partially from the South Yorkshire district, and the proportions of each description used from day to day varied very considerably. It would, therefore, be very difficult to say what was the initial illuminating power of the coal gas, as it was not convenient to have an assistant in the laboratory day by day to ascertain it. It was the practical effect of the enricher that was all important at this particular time; and as this was satisfactory, investigations as to the why and wherefore were deferred until a less busy season.

Taking, therefore, the months of December, January, February and March, the results obtained on the No. 3 section of the works during this period have been as follows, with the oxy-oil gas passing into the bulk at the coal gas condenser inlet, and consequently through the whole of the purifying plant, into which a percentage of oxygen, either pure or as air, was admitted:

Coal gas made with enriched gas, in bulk.....	139,526,3000 cu.ft.
Average illuminating power, as tested on standard photometer (Board of Trade stamped No. 257) against Methven screen...	18.12 candles.
Oxy-oil gas made, containing 15 per cent. of oxygen.	1,810,610 cu. ft.
Percentage of enriching gas in bulk.....	1.29 candles.
Percentage of enriching gas added to bulk....	1.31 per cent.

During this period the illuminating power of the coal gas before enrichment was frequently ascertained by admitting the oxy-oil gas at the station meter inlet for an hour or two at a time.

In the four months under consideration the average results yielded a gas of 16.83 candle power without enrichment. This is a higher candle power than is subsequently given in the results of the experimental work carried out during April for the purpose of this paper. It is, however, correct, as during the earlier period the average production per ton of coal was 10,094 cubic feet, whereas during April the production was increased to an average of 10,656 cubic feet of 16-candle power gas. The foot-candles produced per ton of coal during the two periods are respectively as follows: 33,976 and 34,099, after deducting the percentage of enriching gas from the made of each period. The author's reason for obtaining the smaller yield per ton of coal during the winter months was simply to maintain the illuminating power of the gas; as, owing to the larger make, and to the fact of the installation of the oxy-oil plant being incomplete, the only alternative was a poorer gas, which, in his opinion, it was not expedient to supply. These results have, therefore, yielded an increase of 1.29 candles for the addition of 1.31 per cent. of enriching gas, or a gain of 0.98 of a candle per cent. of enriching gas added.

The cost of enrichment per candle during the period under consideration is given in the following statement, which, however, includes items not fairly chargeable to the process, as well as the fact of the labor being in excess, owing to the small production per day. It is, however, better to overstate than to underrate such items when dealing with the large interests to which this process is intended to apply.

Statement of the Cost of Enriching 137,715,690 *Cubic Feet of* 16.83 *Candle Coal Gas to the Extent of* 1.29 *Candles during December*, 1893, *and January, February and March*, 1894.

Oil used, 66 tons, at 67s. 6d. per ton.....	£222	15	0
Oxygen, 271,590 cu. ft. at 4s. 6d. per 1,000 cu. ft. ..	61	2	0
Labor, 12s. per day, 121 days	72	12	0
Fuel, 15 cwt. per day, 121 days	22	15	0
Interest and sinking fund on—			
Plant, 4 months, at 4½ per cent. on £500.....	7	0	0
Wear and tear on ditto, 4 months.....	10	0	0
	£396	4	0
Royalties	22	12	6
Total...	£418	16	6

Coke produced, 2 tons 15 cwt. — 4 per cent. on the weight of oil.

The number of candles added to the bulk of gas in thousands of cubic feet was 179,988; so that the cost per candle-thousand, including all charges, equals 0.52d. per candle of enrichment.

As will be seen from the above, the cost of the oxygen represents upwards of 14 per cent. of the total enrichment; but, as is subsequently explained, for this additional 14 per cent. in the cost of producing the enriching gas, a gain of 40 per cent. is obtained from the oil used. The cost of oxygen can, however, in the author's opinion, be very materially reduced by utilizing the waste heat from the coal carbonizing plant. The heat leaving the regenerator settings would be sufficient for this, supplemented by a separate generator for use when waste heat is not available. This would not only save the cost of the fuel, but it would also do away with the labor in connection therewith, which is the chief item in the working expenses. In fact, if this arrangement had been carried out at Huddersfield, the only labor entailed in working the oxygen plant would have been in connection with charging and emptying the purifiers, which does not occur, on an average, more often than once a month. The vacuum and compression pumps being in the exhauster house, the one attendant could with ease attend to the working of these.

For the purpose of this paper the author conducted, during April last, some large-scale experiments, with a view of ascertaining the effect of the oxygen upon the production of oil gas in general. It is, however, such a large subject and of such a peculiar nature that his opportunities have only enabled him to ascertain the bare facts, which, however, are somewhat startling; and he does not profess to be able to explain them further than that the experiments have been very carefully conducted, and he sees no reason to doubt their accuracy. With this object in view, preparations were made for a few days' run with oil alone, and without the admixture of any oxygen with the resulting gases; the whole plant being stopped for a few hours previously to beginning the test, in order to start clean, and to remove all carbon from the feed pipes and retorts, so as to ascertain the amount of solid residue left after retorting the oil.

The gas produced during the experiment, together with the coal gas, was admitted to one particular gasholder, which rose to a total height of 72 feet above the water line, and contained 934,000 cubic feet of gas. No other gas was mixed with this; and, after standing for six hours, at 6 P.M. this particular holder was put on for the town's supply, and photometrical observations taken every five minutes until 10 P.M., both on the works and on the district photometer, which is about 1½ miles from the works. When shut off, 225,000 cubic feet of gas remained in the holder; and this was tested out on the following evening. The experiment lasted over a period of 24 hours, during which time 934,000 cubic feet of gas were produced from the coal and oil combined; the production being at the rate of 10,803 cubic feet per ton of coal.

During the 24 hours of this test, the yield of gas from the oil was very small—amounting only to 14,080 cubic feet from 17 cwt. of oil, which is equal to 16,560 cubic feet per ton. As far as was known, the heat was the same as usual at starting; but it was found necessary to employ more retorts, to crack the residuals as produced, than was customary when using oxygen. Subsequent experiments have, however, thrown some light upon this point. When cracking oil without oxygen, the average make per ton of oil has been 20,430 cubic feet of 58-candle gas, which is equal to 236,988 candle feet per ton of oil. The average pro-

duction per ton of oil during the four winter months, with 15 per cent. of oxygen, equals 27,433 cubic feet of 70-candle gas, or 384,062 candle feet per ton. This greater yield of gas when using oxygen appears very mysterious, and is at present inexplicable on scientific grounds. This fact, however, led the author to conclude that a greater quantity of residual had been returning to the retorts during the first oil experiment than was usual when using oxygen, a proof of which was the necessity of employing more retorts for residuals, and less for fresh oil.

This frequent return of the residuals naturally reduced the heats, without its being discovered until too late to attempt to alter the experimental run. The 17 cwt. of oil used yielded 14,080 cubic feet of gas, which was equal to 1.5 per cent. of the total production. For this 1.5 per cent. of oil gas (illuminating power not ascertained) an increase of 1.54 candles was yielded in the bulk of gas put into the holder. After standing in the holder for six hours, the gas was turned on for the town's supply at 6 P.M., and photometrical observations were taken every five minutes until 10 P.M., both at the works and on the district photometer, about 1½ miles from the works. When shut off, 225,000 cubic feet of gas remained in the holder, and this was tested out on the next evening. The following statement summarizes the results of this batch of oil enriched gas from beginning to end :

Statement giving Results of the Permanency of 934,000 ***Cubic Feet of Oil Enriched Gas put into a Gasholder during*** 24 ***Hours' Work, and Tested Out until Empty, after standing*** (*A*) 6 ***Hours, and a portion*** (*B*) 6 ***Hours on one Day, and*** 20 ***Hours following.*** [Average quality of gas put into holder, 17.54 candles.]

Time.	Works Photometer. Candles.	Time.	District Photometer. Candles.
7.00 to 8.00 P.M.....	17.05		
8.30 to 9.25 "	16.82	8.30 to 9.30 P.M.....	15.69
9.30 to 10.05 "	16.60	9.30 to 10.30 "	15.86
Next day—			
6.00 to 7.00 P.M.....	16.55	6.30 to 7.30 P.M....	15.69
6.00 to 8.00 "	16.57	7.30 to 8.30 "	15.69
	5)83.59		4)62.93
Average.....	16.72	Average.....	15.73

These results are very interesting when closely examined. In the first place, the enriching effect of the oil gas was extremely good at the station meter outlet ; being, practically speaking, 1 candle per cent. of enriching gas added. After the bulk had been allowed to stand, however, for a period of six hours and was then tested, the enriching effect had fallen from 1 candle to 0.7 candle per cent. of enricher. The quality of the bulk continued to fall uniformly from hour to hour ; the last being 16.6 candles. This, practically speaking, was the limit of fall, as on the following evening the readings were 16.55 and 16.57 candles. The average enriching result obtained at the holder outlet from this batch of 17.54-candle gas put into the holder was equal to 0.48 candle per cent. of oil gas.

With regard to the traveling powers or permanency of this particular batch of gas during distribution, some further interesting results were obtained. The gas which left the works between 8.30 and 9.25 P.M. at 16.82-candle power, yielded only 15.69 candles on the district photometer, the latter quality remaining practically constant during both days. On the day previous to these tests being made, the permanency of oxy-oil enriched gas during distribution had been carefully examined, with the result that practically no difference could be detected between the works and the district photometer, after making the usual correction, as well as for the difference in altitude, which was done in all cases. Nothing whatever was done to either photometer between these tests with oxy-oil enriched gas and with oil enriched gas. It is, therefore, only fair to accept them as reliable tests.

Not feeling altogether satisfied with the preceding test, on account of the small make and the unstable character of the resulting gas, the author determined to again work the plant for oil gas alone, and before starting he had the heats raised slightly above the customary extent. A total quantity of 74 cwt. of oil was used upon two separate experiments, and the following is a summary of the results :

Oil used.....	74 cwt.
Gas per ton.....	20,430 c. ft. of 58 c.p.
Combined gas produced.....	3,239,000 cubic feet.
Coal gas.....	3,163,409 "
Oil gas.....	75,591 "
Percentage of oil gas added.....	2.38 per cent.
Oil gas.....	2.33 "
Average illuminating power of coal gas	16.00 candles.
Ditto enriched gas.....	17.83 candles.
Enriching effect of oil gas.....	0.76 per cent.
Coke residual equal.....	6.30 "
Candles added per 1,000 cubic feet....	5,929

From the foregoing results, some useful comparisons can be made as between oxy-oil gas enrichment and simple oil gas enrichment, in which the benefits of using oxygen in connection with the production of an enriching gas from liquid hydrocarbons are strikingly demonstrated. Taking the cost of oil used per candle of enrichment in either process, the result with oil at 67s. 6d. per ton is :

Average cost of oil only, per candle of enrichment during December, January, February, and and March, oxy-oil process, illuminating power yielded *out* of holders.	0.29d. per candle-thousand.
Average cost of oil per candle of enrichment from experiments with same plant without using oxygen, but working a slightly higher heat, and taking illuminating power put *into* holder.	0.49d. per candle-thousand.

This shows an advantage of 40 per cent. in the economy of oil when oxygen is used in conjunction therewith, from which must be deducted the cost of the oxygen, which equals 0.08d. per candle thousand ; resulting in a net gain in favor of the oxygenated oil gas process, as against simple oil gas, of 24 per cent.

The foregoing result is arrived at on the assumption that the simple oil-gas enrichment is as permanent in its effect as is oxy-oil gas, which, from a very large number of tests, has been found to be practically perfect in this respect. As a matter of fact, the author has not found simple oil gas enrichment to be permanent, as the following results will show, which are photometrical readings of the oil gas made, from the 74 cwt. of oil used, in the experiments already referred to :

Statement of the Loss of Illuminating Power During Distribution of Coal Gas Which Had been Enriched With Simple Oil Gas.

	Candles.	Loss on Candle Power.	Loss in Distribution at 1¼ Miles.
Illuminating power of gas put into gasholder.....	17.83	——	——
Illuminating power of gas tested out of gasholders ; the bulk chiefly passing direct into and again out, without standing.....	17.77	0.06	——
Illuminating powers of gas tested on the district.....	17.26	——	0.57

The loss of illuminating power in the distribution of the oil-enriched gas should therefore be deducted from the enriching effect of the gas put into the holder, and the comparison made on the adjusted basis. The following statement will therefore show the comparison previously given corrected for loss of illuminating power during distribution, and will form a fitting summary to the conclusion of this paper.

Cost of oil and oxygen per candle of enrichment during December, January, February and March, oxy-oil process, gas distributed 1¼ miles .....0.37d.

Cost of oil per candle of enrichment, but without oxygen, gas distributed 1¼ miles.....0.73d.

Difference in favor of the oxygenated oil gas as against simple oil gas enrichment, 49 per cent.

Gindele's Condenser and Drip for Gas Service Pipes.

On May 29th U. S. Letters Patent (No. 520,675) were granted to Mr. Albert H. Gindele, of Jersey City, N. J., for a new and improved condenser and drip for gas service pipes. Using the words of the specification :

The invention relates to an improved device for arresting the water of condensation that may pervade illuminating gas, and that is carried into house service pipes, the object being to provide a novel, simple and efficient appliance and locate it between the house meter and service pipe, so as to in a large degree remove excess of moisture from the inducted gas and prevent the deposition of condensed water in the meter.

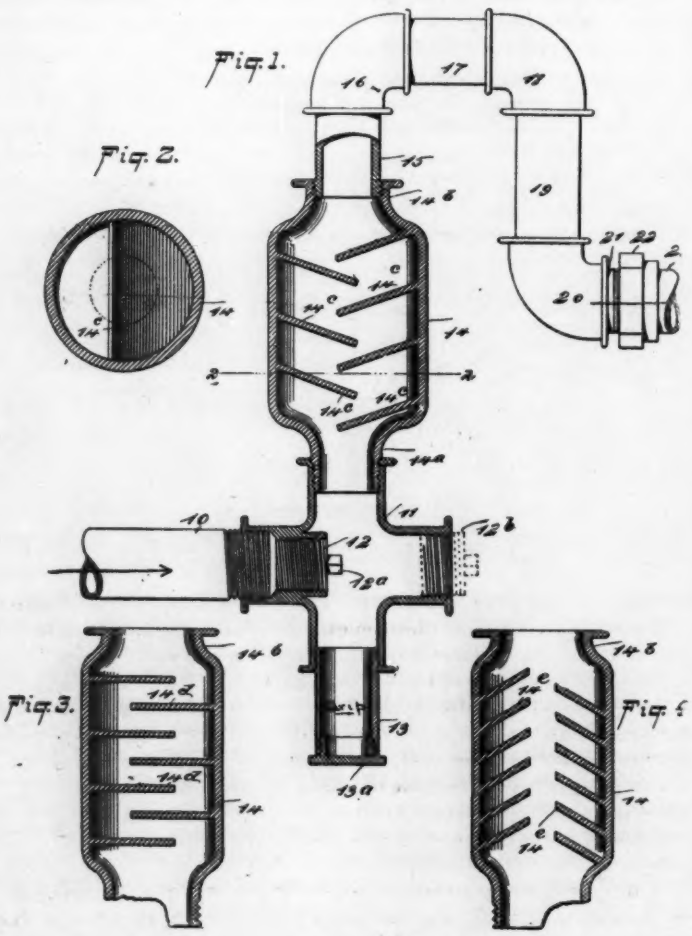
To this end, my invention consists in the construction and combination of parts, as is hereinafter described and claimed.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar figures of reference indicate corresponding parts in all the views shown.

Figure 1 is a partly sectional side view of the improvement in position between the inner end of a house service pipe and a meter connection

shown in part. Fig. 2 is a sectional plan view of parts, on the line 2—2 in Fig. 1. Fig. 3 is a sectional side view of a modified form for a main feature of the invention ; and Fig. 4 is a sectional side view of another modification of the part shown in Fig. 3.

In the drawings, 10 represents the inner end portion of a house service pipe provided to conduct gas from the street main into a building, usually in the basement or cellar. Ordinarily there is a lead pipe connection attached to the inner end of the service pipe such as 10, having a meter stopcock introduced between these parts, the opposite end of the lead pipe connection being secured by a union nut on the inlet post of the meter.



Gas has a tendency to absorb moisture and carry it a considerable distance from the point of distribution, the deposition of this moisture by condensation in gas meters being objectionable, from the fact that it impedes the proper action of a meter, and by waterlogging the diaphragm of a dry meter such as is now in common use, the holding capacity of the meter is reduced, so that its value as a measure of quantity is impaired.

To obviate the defects incidental to ordinary methods for the introduction of gas from street mains through house service pipes into gas meters, the present improvement has been provided, comprising features of construction as follows : A 4-way fitting 11, of a suitable size, is screwed upon the inner threaded end of the service pipe 10, the branch of the fitting that is thus connected being bored and threaded internally in two diameters, the smallest at the inner part of the bore, so that a sealing plug 12, which is slightly tapered and externally threaded, may be screwed into the smaller threaded bore of said branch, as represented in Fig. 1, said plug being introduced through the larger threaded bore of the opposite branch of the 4-way fitting, by means of an ordinary socket wrench that is fitted upon the squared projection 12a of the plug, whereby the latter is turned. In the lower vertical branch of the fitting 11, a drip chamber 13 is screwed, its cylindrical body being externally threaded at the upper end, a removable cap 13a being screwed into the lower end of the chamber that is interiorly threaded to receive said cap, as shown in Fig. 1.

An essential feature of the invention consists of the condenser 14. This is preferably given a cylindrical form, having a sufficient length for efficient service, and is contracted in diameter at each end to produce an integral nipple 14a on the lower end, and a neck at the top, said neck 14b being internally threaded, and the nipple threaded externally, the nipple being screwed into the top branch of the fitting 11, as shown in Fig. 1. The condenser chamber 14 is furnished with spaced wings on its inner surface, which may alternate and incline, as shown in Fig. 1 at 14c, or be staggered as represented in Fig. 3 at 14d, or said wings may be arranged as shown in Fig. 4 at 14e, their function being to serve as baffle plates that are adapted to increase the surface of contact for the gas passing through the 4-way fitting in an upward direction, it being understood that when the complete device is in place and gas is to be turned on, the plug 12 is to be removed, and a plug 12b that fits the branch opposite the service pipe 10 is to be inserted, so as to seal the outlet in the fitting, said plug being indicated by dotted lines in Fig. 1.

In the neck of the condensing chamber 14, a nipple 15 is screwed, and on it an L-fitting, 16, is attached in a like manner. From the other end of the L, 16, a nipple, 17, projects horizontally of a short length, and on its other end an L, 18, similar to 16, is screwed, said L, 18, having the nipple, 19, inserted so as to depend therefrom, and on its lower end an L, 20, is secured, these parts having a threaded engagement with each other. A short nipple, 21, is screwed into the remaining end of the L, 20, and a union nut, 22, which is loosely secured on the end of the meter connection, 23, has a threaded engagement with the projecting part of the short nipple, 21. The short end portion of the meter connection, 23, is intended in use to be extended of a proper length for connection with the inlet part of a dry meter of any approved construction (not shown), the other part of said meter being connected with the gas distributing pipes in the house wherein the meter mentioned is located.

In use, when gas is introduced through the service pipe 10, under pressure from the holder at the gas factory, and passes upwardly toward the meter through the connections that have been described, the larger diameter of the condenser 14 and its numerous wing plates will afford extensive surface for an impinging contact of the inflowing gas, which will, by attrition and the cooling effect of the condenser, remove to a great extent the moisture pervading the gas, which by its condensation thus effected will accumulate in drops of liquid, that by gravity will eventually flow into the drip chamber 13, from which it may be readily removed if the cap 13a is unscrewed.

It is to be understood that without departing from the spirit of my invention, the L's and nipples above the condensing chamber, as shown in Fig. 1, may be altered as to their tread and arrangement, so as to reach a meter that by its position will not admit of the disposition of parts as illustrated.

Coke Making in the South.

Mr. Richard Thomas, in a paper on coke, read before the Alabama Industrial and Scientific Society, said : I have experimented a great deal in trying to get rid of the sulphur from the coal. They claim that they can get rid of a considerable quantity by burning the coke on moist ground in clamps or milor. It is more reasonable that they can, if we examine the process. The flues made of lumps of coal or wood, then the smaller flues, at intervals, acting as chimneys, we get the strongest heat in the bottom of the pile. This would decompose the hydrogen of the water. The hydrogen would have a chance to take up some of the sulphur and the two could then escape through the upright flues, or chimneys, as sulphurreted hydrogen, and the oxygen would then form CO or CO^2. In burning in the bee-hive ovens, if the hydrogen and sulphur would unite, they would have to pass through the layer of fusible coal, when most of the sulphur would be taken up in this fusible carbon, and the balance carried off as sulphureted hydrogen gas, or in the liquid tar and ammonia.

My impression is that the fusible paste, preceding the burning into coke, holds the sulphur, and prevents it from escaping with the other gases. I have tried steam through pipes, under the floor of the oven, with holes at intervals for the steam to pass up through the charge, but it failed to carry off the sulphur, and there was no improvement in the coke. I have tried slack lime mixed in the coal, also thick lime water. The furnace man was under the impression that the sulphur would unite with the lime and be carried off with the cinder. There was no improvement in the iron by the process, and we discontinued it. We tried washing the slack with salt water from the sea. That did no good in that coal. I have experimented since then by washing some of the Illinois coal in the water running from the salt works, and the sulphur would take up the oxygen so quickly that it formed sulphurous acid, and as it acted on the coal it gave out a large volume of gas. The ovens would light up, and the gases wonld burn and bring

the ovens into a white heat, but the coal would not fuse and coke. We made a change and used water from an old mine, and the coal would fuse and coke right along. I think it is very clear to be seen that in the piles of slack exposed to the atmosphere, the sulphur leaves the coal and forms sulphurous acid. This is again carried off by the water, but the trouble again is that the coal is so heated by the action of the sulphur, it will not coke. The only way to reduce sulphur in the coke that I know of is washing the coal before you put it into the ovens.

When sulphur is in pyrites of iron, or layers, distinct from the coal, we can wash out the greatest part of it; but when we meet sulphur combined in the coal, the case is hopeless. We can neither wash it out, nor burn it out. The like has been mentioned before as sulphureted hydrogen gas, and what is taken out in the liquid tar.

The next point is, can we, by any method, make a larger and denser coke in our ovens. I think that the size of the coke has a great deal to do with the percentage obtained from it in the blast furnace. Suppose we take a piece of coke of the following dimensions, viz., 4 by 4 by 12 equals 224 inches of surface exposed to the action of the hot gases in passing downward to reach the tuyeres. Suppose we break the same into two-inch cubes, we thus make it 24 in number, each of which would have 24 inches of surface, or the pieces as follows: 24 by 24 equals 576 inches, or over 3.5 more surface exposed to the action of the furnace gases.

The open top ovens would make coke, in depth, in the oven, but it broke to the ordinary size in handling. In fact, no oven would coke that depth without flues through the pile, consequently such depth would be in layers, and would have more fracture in it than the ordinary layer.

I saw an experimental oven, built on the beehive principle, with 4 doors. The oven was very high, and would take a charge of 40 tons of coal; but in this, the same as the open top, they made flues, with lumps of coal across the oven, the charge being from 6 to 8 feet deep, and took some 10 days to burn the coke. After being raked out on the ground it was not denser, nor quite so large in size, as the coke made in layers of about 52 inches, in the drag ovens that were running in the same yard and on the same coal.

To get a uniform coke, the coal must be coked either from the top downwards or from the sides inwardly. Any attempt to use flues in the sides of the beehive ovens does harm to the size of the coke, as the ovens would coke around the walls inwardly and meet a short distance from the sides—the crest burning downward to the point of meeting. There would be a fracture in the coke, thus doing more harm than good. There would be no benefit in getting the sides coked in a shorter time, unless the whole oven would come ready at the same time. We would lose considerable of the fixed carbon of one in waiting for the other part to come ready.

I have tried the rolling of the Illinois coal to make it closer. I have a fixed chain, one from the front end, the other attached to the roller from the back end, in the Thomas ovens, and would pull the roller through several times over the top of the charge, but failed to make the coke denser. I have made quite an improvement in the size of the coke by rolling first, then attaching to the roller, the last time a piece of plank lengthwise across the oven. In this I inserted spikes, to pass through the plank, 6 inches long, something like an arrow, which we pulled through after the last rolling, as the spikes penetrating the coals would loosen them. In the way they traveled the gases would flow freely upwards through the crevices, and the crust would form solidly the width between the spikes, thus leaving the ovens, when ready to draw, with coke about 6 inches wide in size.

In the whole length of the oven the coal was high in volatile matter. The coal carries 51 per cent. fixed carbon and the coke 90 per cent. when the coal is so high in volatile matter. The coke as a general rule is very light, taking 3,030 inches to make a bushel of 40 pounds.

I tried several other ways with the Illinois coal. I managed to coke the Big Muddy coal in a drag oven, 24 inches, in 24 hours, by having flues in the bottom, covered by a 2-inch tile. The gas would pass down through two flues in the end wall of the oven; then pass through two flues, one on each side, under the bottom, and return through the middle into the chimney in the back end of the oven. The oven had so much heat in the bottom that it coked upwards at the same rate as the top charge would coke downwards. Where the two met there would be a break in the charge, each layer, about 12 inches deep. The top coke was not so good as that which was made in the usual way. I accounted for this from such a large volume of gas passing upward in such a short time; the bottom coke was larger and denser, but in cooling the charge inside the oven the bottom coke would not clear. It looked black and the color condemned it.

I built some ovens and passed the heat of an oven in full heat over the top of the oven newly charged. They were constructed by making a flue in the back end of drag ovens; a damper was fixed in the flue, which was closed when an oven was drawn and charged. The chimney was reversed and put on the front end; thus the heat of the oven in full work would pass from back to front, over the coal, newly charged. My aim was to try to coke in less time, but I found that the burnt up gases of one seemed to retard the burning of the other worked, and came ready the same as the other ovens, in 48 hours, but there was no gain in the operation.

My experience has convinced me that the only way to make a uniform coke is by the single batches, of one depth, and let the coke start from the one end and burn one way until it reaches the other end.

All coke for the present high furnaces should come ready about 20 hours before it is drawn, and the oven luted up close to prevent the burning of the fixed carbon; or put the lid on, or damper; but care should be taken that the oven is not in too much heat when putting on dampers. By closing the ovens up, in white heat, they are liable to bring down arches. When the charge is allowed to cool down by degrees, before it is drawn, it gives the coke the anilin process, which makes it much stronger. If, on the other hand, the charge is cooled down with water when it just comes ready, the coke in the middle of the pieces being at almost white heat, the contraction of the outside of the pieces, when cooled, and the force of the expansion from the inside, would have a tendency of fracturing the walls of the cells of the coke, and reduce its strength considerably, making it more liable to break up in handling and reduce its strength to withstand the burden in the blast furnace.

An Improved Mercury Photometer for High Temperatures.

By Mr. W. NIEHLS.

The ordinary mercury thermometers give accurate values up to 250° C. When the thermometer tube above the mercury is filled with nitrogen under pressure, readings are possible up to 450° C.

Early in 1893 I submitted to the Physikalisch-Technische Reichsanstalt at Charlottenburg, Berlin, which, as is well known, tests the correctness of normal thermometers, etc., models of high temperature thermometers which were capable of giving accurate readings up to 550° C. Since then minor details of construction have been satisfactorily completed, and in the following I will briefly describe the perfected instrument.

At the outset it was necessary to secure a variety of glass which does not soften below 600°. For this purpose the borosilicate glass of Jena was chosen and has shown itself well adapted in all cases. The graduation is brought directly on the tube, and ranges either from 180° to 550° in single degrees, or from 100° to 550° in intervals of five degrees. The scale is black, for the sake of the greatest clearness, and the method of its preparation is as follows: The thermometer tube is supplied with the requisite amount of mercury, and then completely filled with carbon dioxide under a pressure of 20 atmospheres. In this condition the tube is heated and graduated. The mercury is then removed, black enamel is rubbed in the scale, and the tube is introduced into a muffle where the scale is brought out clearly in enamel.

This treatment in the muffle has not only the advantage of yielding a permanent scale which resists strong acids, but it also brings about an artificial "ageing" or "seasoning" of the thermometer. In other words, it decreases in a marked degree the tendency of a thermometer to give too high readings as time goes on. This is evident from the following experimental data:

Thermometers graduated to 360°, which showed ordinarily a rise of 8°–10°, gave, after this preliminary treatment, when heated for 10 hours to 340°–350°, an increase of 0.6°–0.8°. Those graduated to 400° showed, under the same conditions, a rise of 1.5°–2°. In the case of thermometers graduated to 550° the rise under the same conditions was 2°–3°. After further heating for 10 hours the rise was 0.4°–0.6°. On the contrary, thermometers graduated to 550°, but not exposed to the "seasoning" treatment, showed, after being heated for 10 hours, a rise of 16°–19°, and after a further period of 10 hours a rise of 4°–6°, while further increase was naturally to be expected.

A further improvement of the high temperature thermometer is the coating on the back of the tube which greatly facilitates readings. This same result has been secured in the construction of ordinary thermometers by introducing into the back of the tube a strip of enamelled glass. The difference in the coefficients of expansion renders this impossible in the case of the high temperature thermometers. The strip of enamelled glass has been replaced, however, very satisfactorily by

a simple coating of enamel which is fused upon the surface of the tube at the same time that the figures of the scale are produced. The enamel on the rear of the tube, as well as that of the graduation, are totally unaffected after prolonged exposure to high temperatures.

An extended use of these thermometers is to be expected not only in laboratories, but in many branches of chemical industry, such as tar works, petroleum refineries, anilin works, etc.

I would mention in this connection the great help I have experienced in using Mahlke's "thread thermometer" for obtaining accurate readings at high temperatures. This gives the proper correction for the error due to the projection of a part of the mercury column of the thermometer outside of the substance or confined space, the temperature of which is being measured. In the case of long thermometers and high temperatures this error may reach 30°. Mahlke's thermometer is hung alongside the projecting part of a thermometer in use, and is so arranged as to give at once the reading for the number of degrees to be added to the temperature indicated in order to correct the error mentioned.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

A CORRESPONDENT at Port Huron, Mich., writing under date of June 28th, says: "The gas war is still on here—good coal and water gas as against greased wind. The Pittsburgh stockholders will be tired before they see a dividend, selling gas at $1 per 1,000 for light and 50 cents for fuel, with 10 per cent. discount."

THE annual meeting of the San Jose (Cal.) Light and Power Company was held on June 21st, when the following Directors were elected: C. W. Quilty, Uriah Wood, Amasa Eaton, J. K. Prior, Gus. Lion, Lloyd Tevis and G. H. Roe. The report of Secretary Gillespie showed extensive improvements and additions to the plant and a very satisfactory condition of business; and the management received the full indorsement of the shareholders. The Board of Directors organized by electing the following officers for the ensuing year: President, C. W. Quilty; Vice-President, Uriah Wood; Secretary, W. W. Gillespie; Treasurer, C. T. Ryland.

WE understand that Mr. Hiram Merrill, for many years Manager of the New Gas Company, of Janesville, Wis., has disposed of his interest therein to the United Gas Improvement Company, of Philadelphia.

THE proprietors of the Niagara Falls (N. Y.) Gas Company have ordered a reduction in the selling rates, on the following basis: All gas used for illuminating purposes, $1.80 per 1,000 cubic feet; gas used for heating, cooking and power purposes, $1.20 per 1,000 cubic feet, net, when supplied through a separate meter.

ON June 26th the stockholders of the Danbury and Bethel (Conn.) Gas and Electric Light Company held their annual meeting, the following gentlemen being named as Directors: C. H. Merritt, Jos. M. Ives, B. A. Hough, Alfred N. Wildman, H. Bernd, Edmund Tweedy, Michael McPhelemy, Samuel C. Holley, William Beckerle, Jas. L. White and George W. Merritt—all re-elections, save in the case of the last named, who succeeds to the vacancy occasioned by the death of Mr. F. S. Wildman.

THE transfer of the franchise and property of the Hastings (Neb.) Gas Company was made about a fortnight ago to John W. Hayes, of Philadelphia; T. M. McGuire, of St. Louis, and J. G. Schaufaulen, of Baltimore. The purchase price is said to have been $60,000, and the purchasers are the parties who recently received a franchise from the city under the name of the Hastings Illuminating Fuel Gas Company, who proposed to put in an opposition plant. They will operate under the terms of the new franchise, and will equip the works with the Hayes system of manufacture. The maximum selling rate is to be $1.60 per 1,000.

SOME days ago the Borough Council, of Sharon Hill, Pa., adopted an ordinance granting the Darby Gas Company the right to supply gas in the borough.

THE proprietors of the Akron (O.) Gas Company are endeavoring to secure a franchise which will enable it to operate in the city with some degree of security. Just now the Company is doing business practically at the discretion of the City Commissioners and the City Council, and the Company has consequently no rights which may not be abrogated at the option of the bodies named. The Company asks for a franchise to run 10 years, and agrees, in consideration of the grant, to furnish gas to private consumers at the maximum rate of $1.35 per 1,000, the gas to be not less than 22 candles in illuminating value. The Company offers every facility to the city authorities for ascertaining whether its proposition is reasonable, even to opening its books for their inspection.

THE Board of Administration of Cincinnati recently adopted the following: "*Resolved*, That the Cincinnati Gas Light and Coke Company, now being the owner of certain poles on the city's streets, is hereby directed to replace the existing poles with poles 50 feet in height, on which may be placed, in addition to the space required by said Gas Company, 6 eight-pin cross arms, for the use of the Cincinnati Edison Electric Company, the cost of such re-erection and maintenance to be borne and contributed by the occupying Companies in proportion to the space required, in accordance with the terms and conditions of ordinance No. 4285."

THE Key West (Fla.) Gas and Electric Light Company has increased its capital stock to $250,000 from $75,000.

IT is with sincere regret that we announce the death of Mrs. T. G. Lansden, whose demise occurred on the morning of the 2d inst. Interment was made in Springfield, Ills., on the 4th inst. Mrs. Lansden was a patient sufferer for many years from a lingering disease, and her fortitude continued to the last.

THE following explains itself:

LACONIA, N. H., June 26, 1894.

To the Editor AMERICAN GAS LIGHT JOURNAL: Your notice of the new gas works now in process of construction here, and your complimentary allusions to Mr. Tarbell and myself are fully appreciated, but the real credit is due to Mr. H. S. Jackson, of Boston for this substantial improvement to our city. Mr. Jackson, who came here an entire stranger to our people, purchased the plant of the old company and promised us an entirely new and modern plant. He has fulfilled every promise he made and the result is the splendidly equipped plant we are now erecting.—Very truly yours, JOHN O'LAUGHLIN.

THE officers of the Laconia Company are: Directors, Elmer H. Capen, H. C. Buck, L. R. Wallis and John O'Laughlin. President, H. C. Buck; Treasurer and Manager, L. R. Wallis; Secretary, Fred. A. Young.

THE Electrical Manufacturing Company of America, which was incorporated last January with a capital of $300,000, the works of which were located at Red Bank, N. J., is insolvent.

THE Board of Gas and Electric Light Commissioners have promulgated their decision on the petition of the Melrose customers of the Malden and Melrose (Mass.) Electric Company, who asked for an improvement in the candle power and a reduction in the price of the electric light furnished by that company; and the decision is of interest in that it concerns the first petition presented to the Board respecting the price and quality of electric lights. The Board says: "As is usual in such cases, but little evidence was presented by the petitioners to show at what price the Company might fairly be required to supply. It was understood, however, that an exhaustive examination of the physical and financial conditions of the Company, as well as its history, would be made by the Board, and that such prices would be established as this study of its affairs should reveal to be equitable. The Company has supplied lights, with arc and incandescent, public and commercial, in the cities of Malden, Medford, and Everett, and in the town of Melrose. No complaint was made respecting the quality or price of the street lamps, but it was expressly stated that these lights were supplied under contracts with the respective towns, which it was not desired that the Board should disturb. It was shown at the hearing, and conceded by the Company, that the commercial incandescent lights, to which the complaint was particularly directed, were in many places of inferior quality, through the failure of the Company to deliver at these points the normal amount of energy required by the lamps. The Company stated that its attention had been called to this matter for the first time by the complaint of the petitioners, and that the remedy could and would be speedily applied. Apparatus designed and believed to be capable of securing to these lamps their normal candle power has since been adopted, and the Board understands from the petitioners that the diffi-

culty no longer exists. No order, therefore, seems to be necessary respecting this part of the petition." The Board then discusses the history of the Company, its financial standing, etc., and at the close says that although the presentation is from customers in Melrose, and their contention is principally respecting the lights in that town, it seems necessary that the price fixed should be applicable through the whole territory within the Company's jurisdiction. The Board recommends that after the 1st day of July, the net rate charged by the Malden Electric Lighting Company for electric lighting shall not exceed 20 cents per 1,000 watt hours, if paid on or before the 25th day of the month in which the bill is presented, which rate is approximately equivalent to 1 cent per lamp hour.

MR. W. H. HAYDEN, who has been in charge of the properties of the Bath (Me.) Gas and Electric Light Company for the past three years as Superintendent, has resigned in order to engage in the general contracting business. His successor is a Mr. Day.

MR. C. H. GIFFORD has been appointed to succeed Colonel Wheelwright on the Massachusetts Board of Gas and Electric Light Commissioners. The new appointee, who is a scholarly-looking and thoroughly capable business man, was born in New Bedford, Mass., in 1833, was educated at Haverford College, and subsequently engaged in the whaling business. He then tried his hand at a general brokerage business, and served a term or so in the New Bedford Common Council. He also was Postmaster of New Bedford during the Harrison administration, was a Director in the New Bedford Gas and Edison Electric Lighting Company, and served on the Board of Managers of New Bedford Union Street Railway Company. Mr. Gifford has always been a consistent Republican.

A CORRESPONDENT at Harrisburg, Pa., forwards the following: "Between Peach and Sassafras streets, in Erie, Pa., is being erected an addition to the plant of the Erie Gas Company. Just south of the plant is a high bluff, and between the buildings and the bank run several railroad tracks. The water from the old canal bed empties out of the side of the bluff, through a 4-foot brick sewer. For a few feet the water runs with no cover and then passes through a 24-inch tile beneath the track, thence over the Gas Company's property to the Erie Bay. It seems that when the Gas Company decided to erect the addition to the plant, it asked permission of the city to divert the course of the water so it would not go over the ground on which it was proposed to build the new plant. This was granted and the Company built a 24-inch tile sewer, with two nearly square turns, which carried the water to the east of the proposed site of the new plant. The erection of the new building had progressed rapidly. The smokestack was erected and the stone walls were at points 9 feet high. The freshet of June 24th had filled the brick sewer to almost its capacity, and the 24-inch tile put in by the Gas Company was unable to stand the pressure and overflowed, covering the ground around the building and undermining the walls. About 50 feet of the east wall, where it was at least 8 or 9 feet high, fell, and the other walls are shaky. No one was hurt. City Engineer Platt was notified of the trouble and having looked over the ground decided that the city would have to change its system of sewer construction at the point where the damage occurred."

SAMUEL SHEREY HOLLINGSWORTH, at one time a prominent member of the Philadelphia Common Council and in active touch with Philadelphia's gas supply, from his serving on the Committee of Councils, died on June 28th. He was a graduate of Yale College (1863), and was a successful lawyer and active politician. He was in his 57th year.

THE Board of Gas and Electric Light Commissioners, in the matter of the petition of certain residents of Cambridge, Mass., to compel the Cambridge Gas Light Company to still further reduce its selling rates, decides: "It does not seem that the price of $1.35 per 1,000 cubic feet will, under the existing condition of trade, more than provide for necessary extensions and a proper return on the capital invested, and the Board considers it unwise to recommend a reduction from this price until the effects of the recent reduction can be more definitely ascertained than is now possible."

CERTAIN parties have applied for and have been granted a charter for the Gas, Heat and Power Company, of Mechanicsburg, Pa. The concern is capitalized in $50,000.

THE Boston *Advertiser* says the statement is made that the Bay State Gas Company had a total of 47,952 meters out on June 1, 1894, a gain of 1,131 over the previous year. The gain was largely in Dorchester, which increased by 701; next came Boston proper, where the addition was 306; then South Boston, 143. In Roxbury, where the competition of the Brookline Company is felt most severely, a decrease of 19 meters is reported.

THE Board of Gas and Electric Light Commissioners, in the matter of the petition of gas consumers that the Haverhill Gas Light Company be compelled to reduce its selling rates, has decreed that the rate be reduced to $1.30 per 1,000 cubic feet, a cut of 10 cents per 1,000.

PRESS dispatches, dated Chicago, July 2, are to the following effect: "Judge Windes to-day entered a decree, modified from that presented last week, dissolving the Gas Trust. The modification suggested by the Court and ordered made is that individual defendants in the proceedings also be bound by the decree. The decree, as entered by consent, finds that the several Companies are incapable under the law of owning the stock of any of the other Companies, and that the certificates of stock issued by the Suburban Gas Company and held by the Chicago Gas Light and Coke Company, are illegal. The Chicago Gas Light and Coke Company is ordered to surrender all the stock of the Suburban Company in its possession. All the Companies are also enjoined from issuing any of their stock to any corporation, foreign or domestic. The Companies are also to refrain from executing any unlawful trust. Within 60 days after the entry of the decree the Companies are commanded to elect, each for itself, a Board of Directors who shall carry on the business of each Company, independently of the others. The result is a practical victory for the Trust."

SINCE the 1st of the month, the gas rate in Brooklyn, N. Y., has ruled at 90 cents per 1,000 cubic feet, and the warlike gentleman named Jourdan (who controls the policy of the Fulton-Municipal Company), and who is second in responsibility for the cut to a certain Blodget (who is said to be in control of the Williamsburgh Company), has been quoted as saying that his Company was ready to sell gas at 75 cents per 1,000. We only wish he would be taken at his word, and kept to it for perhaps a period of two years. That would be long enough. The main trouble with the warlike Mr. Jourdan is he forgets that the United States internal revenue methods of old, and even Police Board methods of later days, are not the factors which win in the long run in straight mercantile businesses. No, General. Peace hath methods which are no less conducive to success than is all the bluster of a bloodless war.

THE Milwaukee (Wis.) *Sentinel* of recent date says: "Numerous complaints have been recently made that the arc lights furnished the city by the Badger Electric Light and Power Company were not of the candle power required in the contract, which demands a 2,000-candle power light. Inquiry at the office of the Board of Public Works showed that the statement that the lamps were not 2,000-candle power is correct. Daniel Kegan, the Chief Clerk in the Board of Public Works, however, said that despite this fact, the Company was living up to its contract. 'The exact reading of that document is,' said Mr. Regan, 'that the lights shall have a nominal strength of 2,000 candle power. Now, about two years ago this same complaint arose, and we sent to Chicago for an expert, who examined the lights and returned a report that under the several rules laid down by electric light men, the lights were of the requisite value. The rule is that all lights having that candle power shall have the strength of 10 amperes and shall be on a circuit having a strength of 45 volts.' This was the case, he said, at Milwaukee, although he declared that the electric measurements given in reality only furnished a light of 1,350 candle power." All of which looks to us that electric lighting in Milwaukee is very much similar to electric lighting elsewhere; in other words, that theoretically a full arc is equal to 2,000 candles of illumination, whereas practically it is equal to something less than two-thirds of that quantity.

THE Fire and Light Committee of the Toronto City Council has been considering the advisability of the city's assuming the operation of a plant for lighting the streets by means of arc lamps, and we imagine that, as a result of its investigations, the city will not go into the scheme just yet. The plant estimated on was presumably up to the maintenance of 1,300 full arcs, and the amended figures showed that such plant and its operation would enable the city to carry on the work at the figure of $103.85 per lamp per annum. The city now pays to private contractors the sum of $108 per lamp per annum.

IT seems likely that Mr. Charles Krecke will get the appointment of Gas inspector for Detroit, Mich.

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

EDITOR—Jos. R. Thomas, C.E.
ASST. EDITOR—T. J. Cunningham.
MANAGER—C. E. Sanderson.

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VENTILATION, SANITARY IMPROVEMENT,
AND GENERAL SCIENCE

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NEW YORK.—AMERICAN NEWS CO., 39 and 41 Chambers Street
Germany.—B. WESTERMANN & CO., of New York.

MONDAY, JULY 9, 1894.

The Market for Gas Securities.

There was some recovery in the quotations for Consolidated, the opening price to-day (Friday) being returned at 128½ to 129½, and holders seem indisposed to accept less than 130. Elsewhere in our columns will be found a letter from Mr. McKeige, Secretary of the Standard Company, in which the gentleman distinctly denies that the Company has sold or proposes to sell gas at less than the legal rate of $1.25 per 1,000. Of course this statement must be taken as authoritative, and we are pleased to give prominence to it; but meanwhile there is a strong feeling of mistrust that rates are not adhered to as rigidly as the Managers of the different Companies claim they are. There are more ways than one of conceding to customers, and as the contest for new business is pretty sharp, it is more than likely that inducements to make a change are held out, possibly in the nature of free gas ranges, etc. The Standard Company has declared a dividend of 1 per cent. on its preferred stock, which is payable on July 10th. The East River Company's engineers are having more trouble with that famous tunnel, and here we are pretty close to August 1st, about which time the drive was to have been completed. It will not be completed by August 1st nor for many a day thereafter.

The Brooklyn situation is still chaotic, and we are told that the Nassau Company is preparing to lay 25 miles of mains in the Williamsburgh Company's territory. Quotations for stocks are fairly well maintained. Chicago gas is steady at 78½ to 79. The regular quarterly dividend of 1½ per cent. was declared and is payable on the 23d inst. Baltimore Consolidated is the same as last week, and the general market for gas shares is dull. The United Gas Improvement Company's quarterly dividend of 2 per cent. is payable on the 14th inst.

To Tap the Central Heat of the Earth.

Engineering Magazine says that the ingenious idea of obtaining an unlimited supply of heat for the generation of power by boring a deep hole and so tapping the central heat of the earth, assuming the correctness of the theory of the existence of a central heat, has recently had some additional data furnished upon which to base further calculations. The deep bore hole at Wheeling, W. Va., shows a temperature of 135° F. at a depth of 5,000 feet, the increase in temperature during the lower part of the bore being about 1° for every 75 feet of depth. This was a more rapid increase than appeared at less depths; but assuming this rate to be uniformly continued, it would require a depth of about 3½ miles to obtain a temperature equal to that of steam at 100 pounds pressure. Just what results might be obtained in volcanic countries does not appear, but surely in such regions steam ought to be produceable by natural sources of heat much nearer the surface. After setting Niagara at work it may be next in order to impress into service either the geysers of the Yellowstone or even Vesuvius himself, and long before the available coal supply is exhausted we may be drawing from natural sources of energy beside which the already paling brilliancy of natural gas shall be as the flickering tallow candle of past days.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks.

16 WALL ST., NEW YORK CITY.

JULY 9.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	128½	129½
Central	500,000	50	100	—
" Scrip	220,000	—	100	—
Equitable	4,000,000	100	185	188
" Bonds	1,000,000	—	106	108
Metropolitan, Bonds	658,000	—	108	112
Mutual	3,500,000	100	151	—
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern		50	80	95
" Bonds	150,000	—	—	100
Richmond Co., S. I.	348,650	50	50	—
" Bonds	100,000	—	—	—
Standard Gas Co—				
Common Stock	5,000,000	100	25	30
Preferred	5,000,000	100	80	—
Yonkers		50	112	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	103	107
Citizens	1,200,000	20	50	—
" S. F. Bonds	320,000	1000	—	101
Equity Gas Light Co.	2,000,000	100	—	—
Bonds	1,000,000	—	—	—
Fulton Municipal	3,000,000	100	130	132
" Bonds	300,000		103	—
Peoples	1,000,000	10	—	70
" Bonds (7's)	368,000	—	100	—
" " (6's)	94,000	—	98	100
Metropolitan	870,000	100	132	136
" Bonds (5's)	70,000	—	100	—
Nassau	1,000,000	25	—	155
" Ctfs	700,000	1000	99	100
Williamsburgh	1,000,000	50	138	145
" Bonds	1,000,000	—	107	110
Out of Town Gas Companies.				
Bay State Gas Co.—				
Stock	5,000,000	50	14½	15
Income Bonds	2,000,000	1000	60	—
Boston United Gas Co.—				
1st Series S.F. Trust	7,000,000	1000	78	—
2d " " "	3,000,000	1000	57	58
Buffalo Mutual, N. Y.	750,000	100	120	—
" Bonds	200,000	1000	95	100
Citizens, Newark	1,000,000	50	155	160
Chicago Gas Company.	25,000,000	100	78½	78¾
Chicago Gas Light & Coke Co.—				
G't'd Gold Bonds	7,650,000	1000	81⅛	81½
Consumers Gas Light Co., Jersey City	2,000,000	100	—	58½
Bonds	600,000	1000	90	94
Cincinnati G. & C. Co.	7,000,000	100	192	—
Consumers Toronto	1,600,000	50	184½	187
Central, S. F., Cal.			90	100
Capital, Sacramento, Cal			—	55
Consolidated, Balt.	11,000,000	100	63⅛	63½
" Bonds	6,400,000		107	107½
Citizens Gas Lt. Co., Rochester, N. Y.	500,000	—	85	101
Bonds	250,000		—	—
Detroit Gas Co.—				
Con. Bonds	.....	.....	60	—
East River Gas Co., Long Island City	1,000,000	100	—	—
Bonds	500,000	100	89¼	—
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1000	—	101
Hartford, Conn.	750,000	25	120	128
Jersey City	750,000	20	190	200
Louisville, Ky.	2,570,000	50	125	130
Laclede Gas Light Co. St. Louis, Mo.—				
Common Stock	7,500,000	100	16¾	17¼
Preferred "	2,500,000	100	67	69
Bonds	9,034,400	1000	86½	86¾
Little Falls N. Y.	50,000	100	—	100
" Bonds	25,000	—	100	103
Montreal, Canada	2,000,000	100	200	208
New Haven, Conn.		25	200	—
Oakland, Cal.			42⅜	43
People's Gas and Coke Co., Chicago—				
1st Mortgage	2,100,000	1000	—	108
2d "	2,500,000	1000	104	105
Peoples, Jersey City		—	160	170
" " Bonds			—	—
Paterson, N. J.		25	99	102
Rochester, N. Y.		50	80	85
Preferred			90	95
Bonds			90	95
Syracuse, N. Y.	500,000	25	—	—
San Francisco Gas Co. San Francisco, Cal.	10,000,000	100	71	71½
Washington, D. C.	2,000,000	20	240	—
Wilmington, Del.	500,000	50	180	182

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966-1 "X. Y. Z.," care this Journal.

DIVIDEND NOTICE.

OFFICE OF THE UNITED GAS IMPROVEMENT COMPANY, DREXEL BUILDING, PHILA., June 28, 1894.

The Directors have this day declared a quarterly dividend of two (2) per cent. ($1 per share), payable on July 14, 1894, to stockholders of record at close of business July 2. Checks will be mailed.

996-1 EDWARD C. LEE, Secretary.

DIVIDEND NOTICE.

STANDARD GAS LIGHT CO. OF THE CITY OF NEW YORK, 71 BROADWAY, NEW YORK, June 29, 1894.

A dividend of one (1) per cent. has been declared on the preferred stock of this Company, payable on July 10, 1894, to stockholders of record at 3 o'clock P.M., July 2, 1894.

Transfer books will be closed from 3 o'clock P.M., July 2, to 10 o'clock A.M., July 11, 1894.

995-2 FERDINAND McKEIGE, Secretary.

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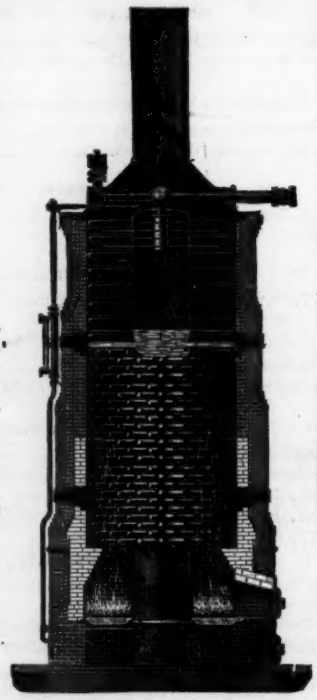

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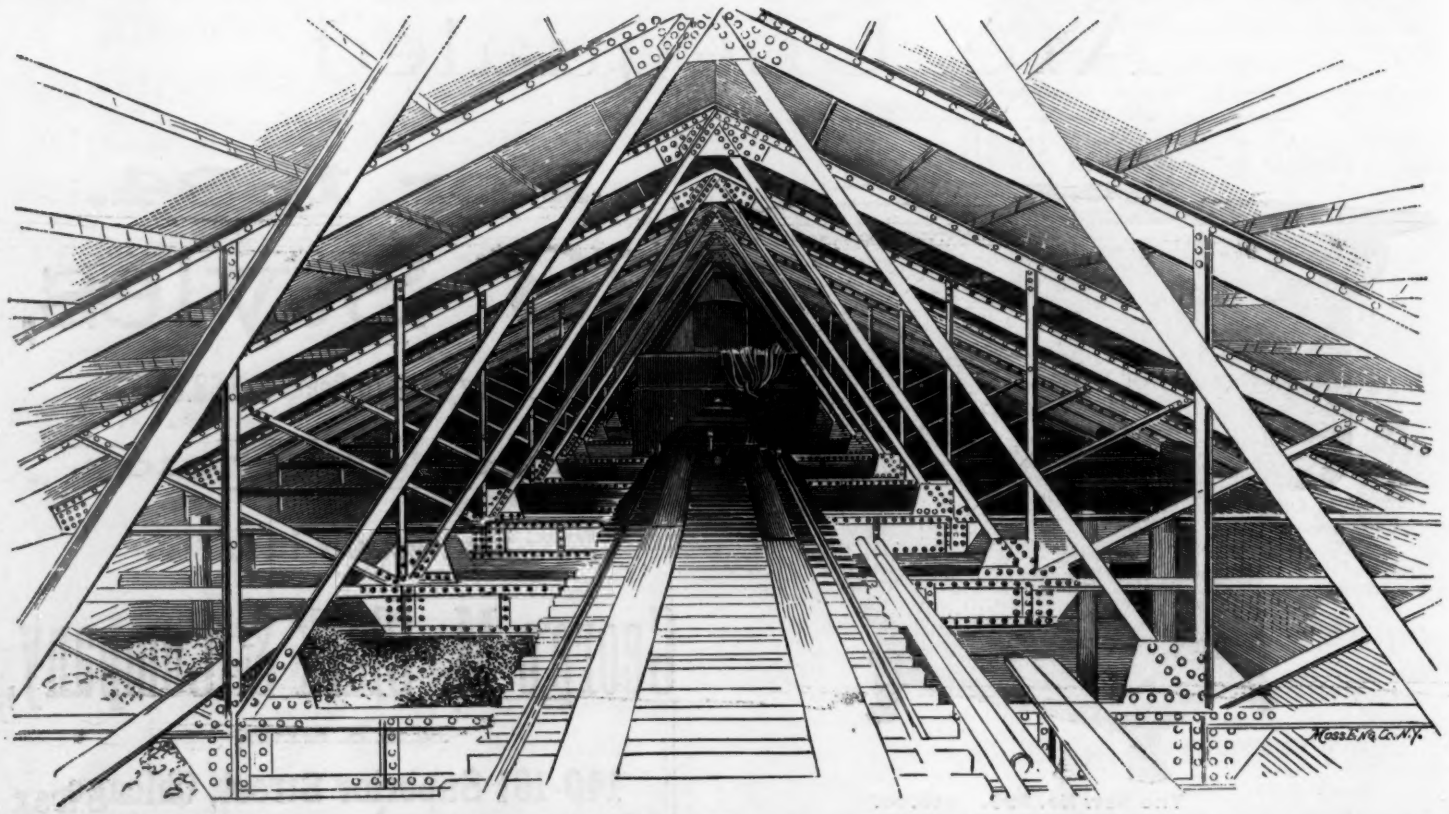

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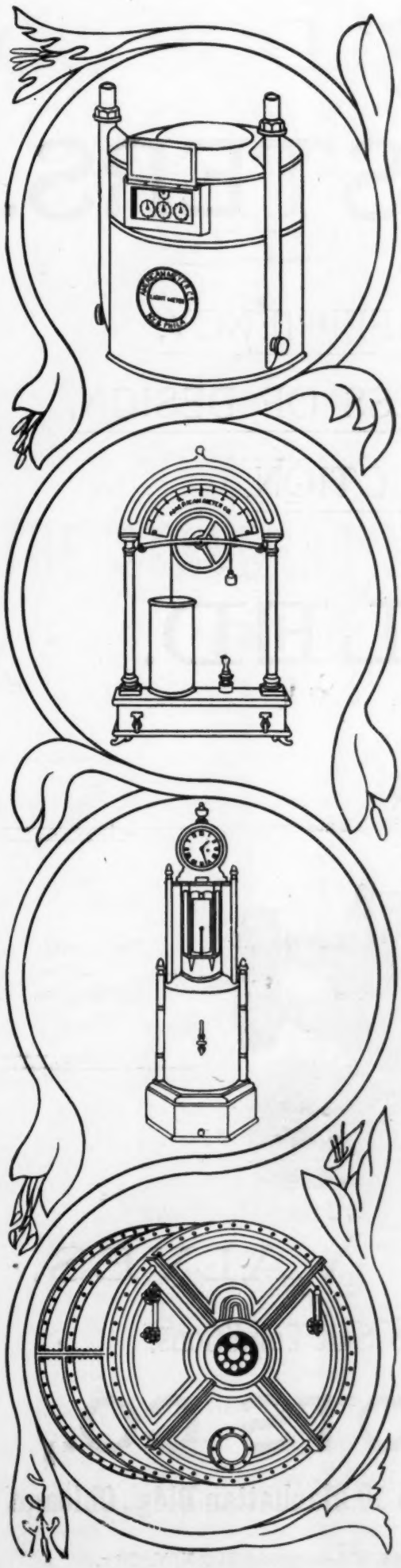

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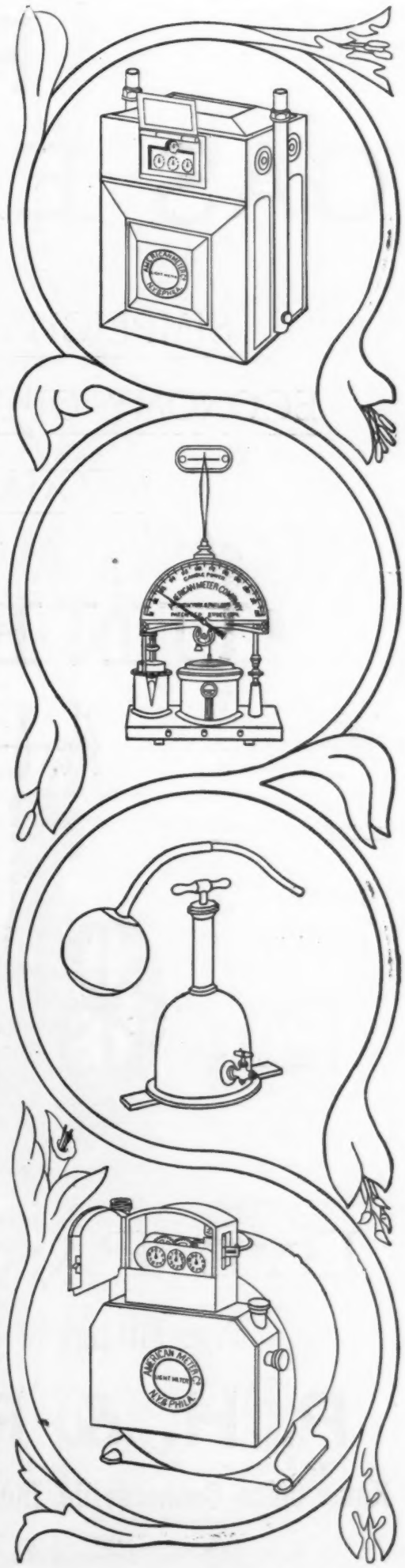
PUBLIC LIGHTING TABLE.

JULY, 1894.

Day of Week.	Table No. 1. Following the Moon. Date.	Light.	Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Extinguish.
				P.M.	A.M.
Sun.	1	8.00 PM	3.40 AM	7.30	3.15
Mon.	2	8.00	3.40	7.30	3.15
Tue.	3	8.00 NM	3.40	7.30	3.15
Wed.	4	8.00	3.40	7.30	3.15
Thu.	5	8.00	3.40	7.30	3.15
Fri.	6	8.00	3.40	7.30	3.15
Sat.	7	8.00	3.40	7.30	3.15
Sun.	8	10.10	3.40	7.30	3.15
Mon.	9	10.30 FQ	3.40	7.30	3.15
Tue.	10	10.50	3.40	7.30	3.15
Wed.	11	11.20	3.40	7.30	3.15
Thu.	12	11.50	3.40	7.30	3.15
Fri.	13	12.30 AM	3.40	7.30	3.15
Sat.	14	1.10	3.40	7.30	3.15
Sun.	15	2.00	3.40	7.30	3.15
Mon.	16	No L.	No L.	7.20	3.15
Tue.	17	No L. FM	No L.	7.20	3.15
Wed.	18	No L.	No L.	7.20	3.15
Thu.	19	8.00 PM	9.50 PM	7.20	3.15
Fri.	20	7.50	10.10	7.20	3.15
Sat.	21	7.50	10.30	7.20	3.15
Sun.	22	7.50	10.50	7.20	3.15
Mon.	23	7.50	11.10	7.20	3.15
Tue.	24	7.50	11.40	7.20	3.15
Wed.	25	7.50 LQ	12.00	7.20	3.15
Thu.	26	7.50	12.30 AM	7.20	3.15
Fri.	27	7.50	1.10	7.20	3.15
Sat.	28	7.50	2.00	7.20	3.15
Sun.	29	7.50	4.00	7.20	3.15
Mon.	30	7.50	4.00	7.10	3.30
Tue.	31	7.50	4.00	7.10	3.30

TOTAL HOURS LIGHTING DURING 1894.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	244.10	January	423.20
February	195.30	February	355.25
March	206.20	March	355.35
April	169.40	April	298.50
May	162.10	May	264.50
June	135.40	June	234.25
July	146.30	July	243.45
August	162.20	August	280.25
September	174.10	September	321.15
October	211.20	October	374.30
November	221.00	November	401.40
December	245.30	December	433.45
Total	2274.20	Total	3987.45



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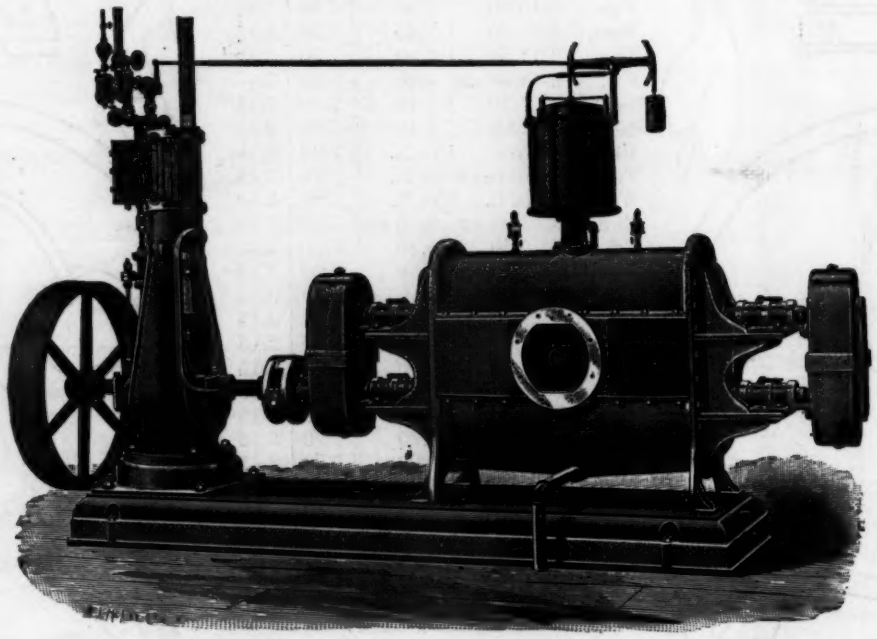

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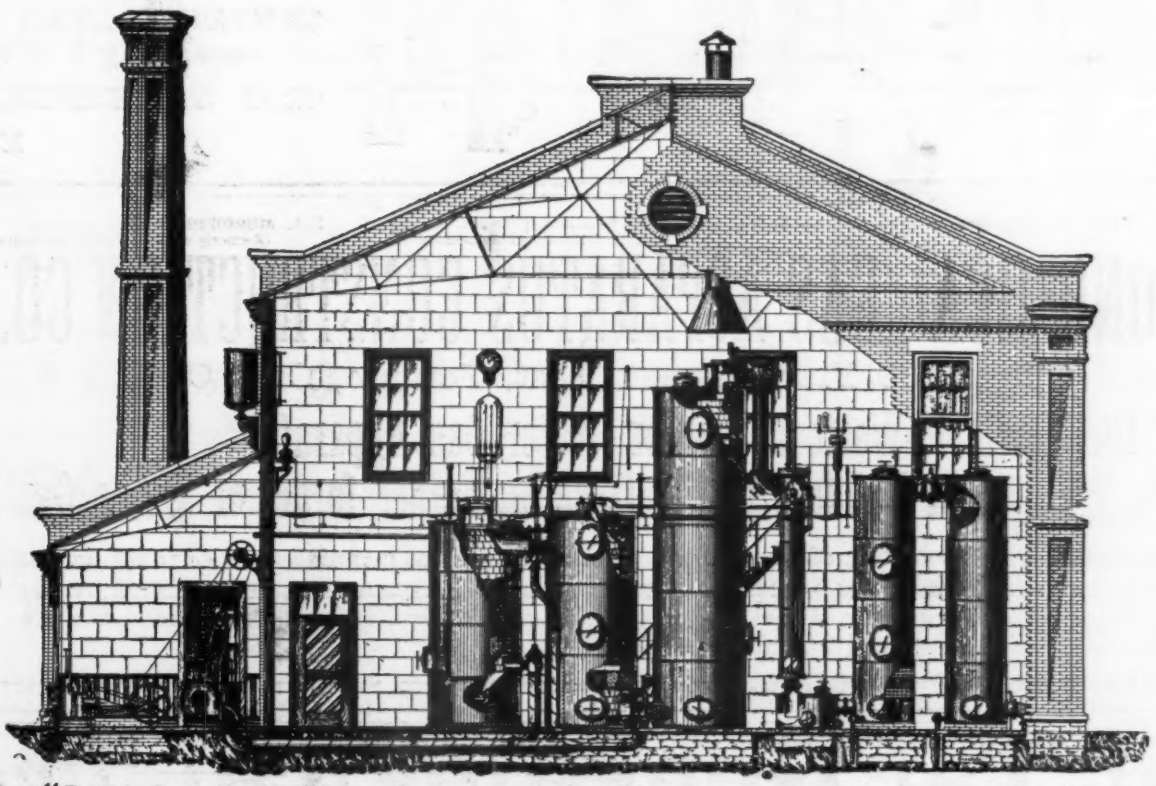

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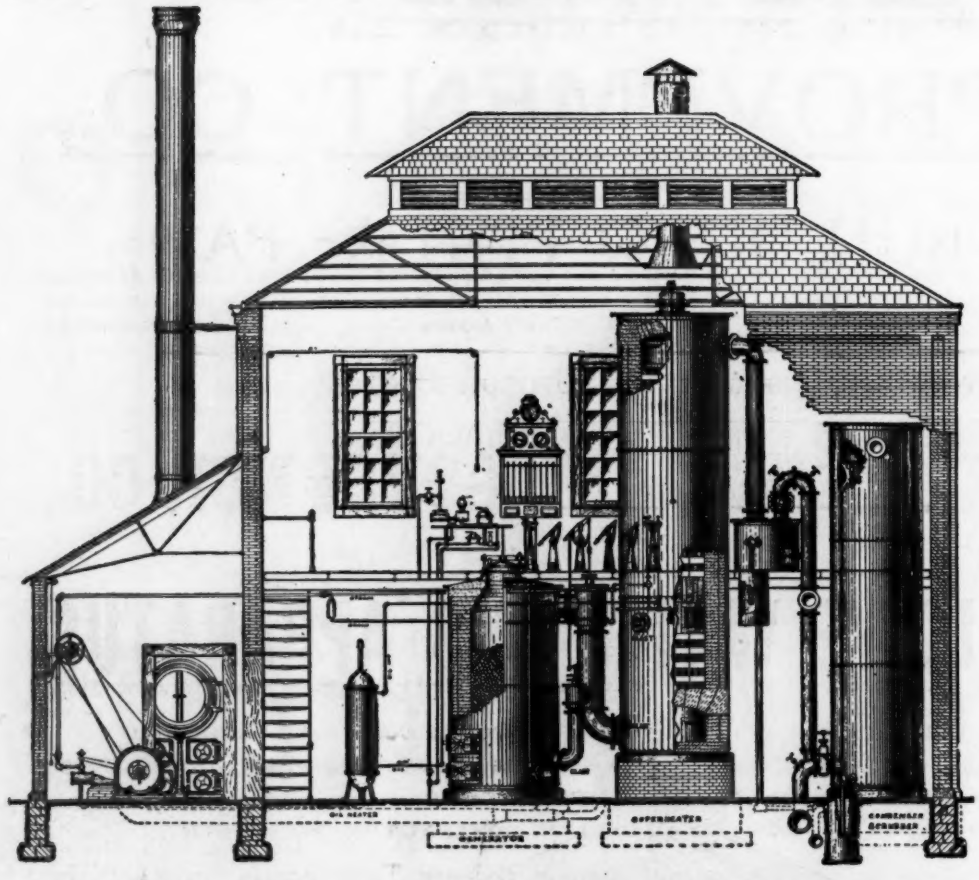

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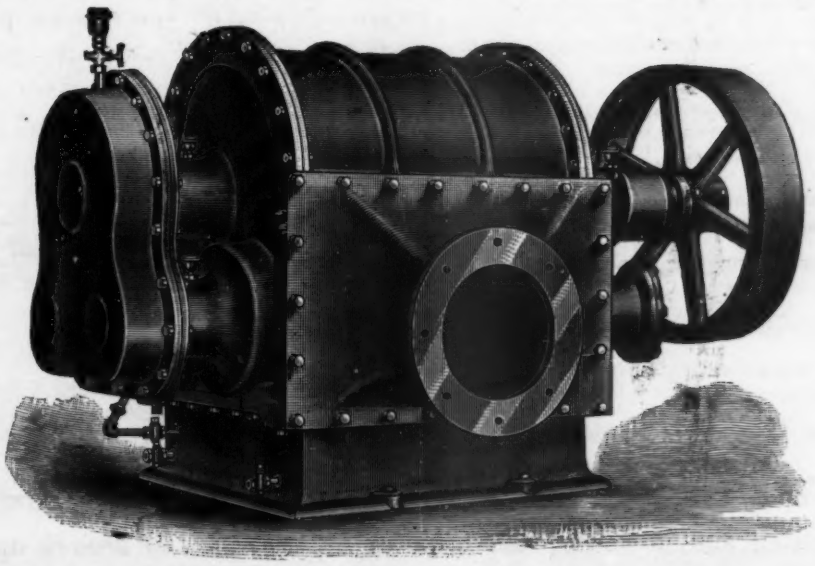

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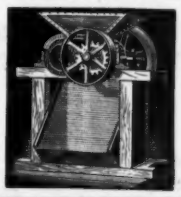

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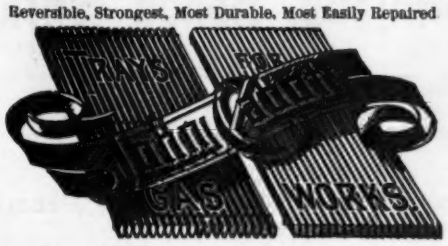

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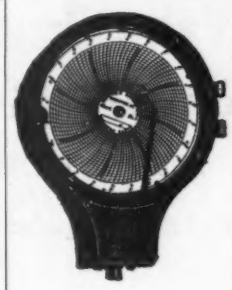

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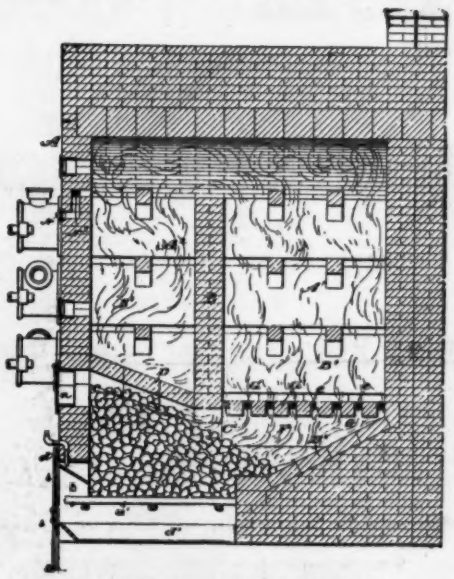

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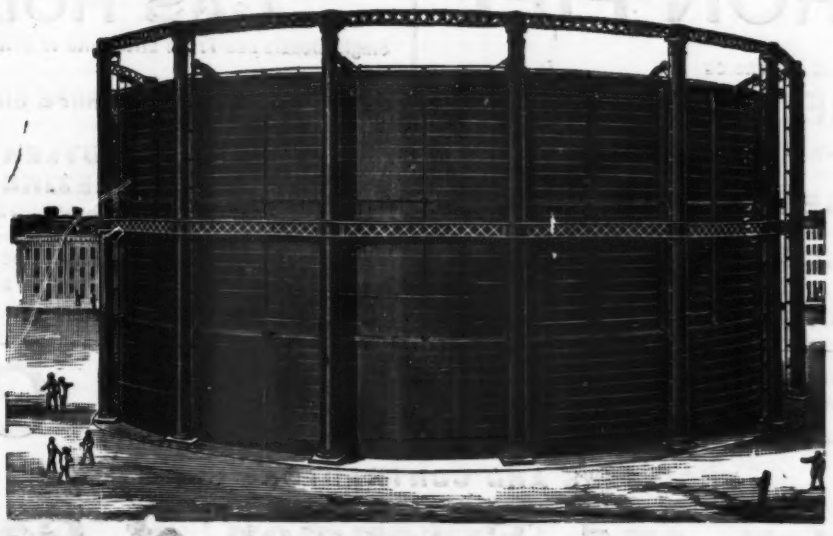

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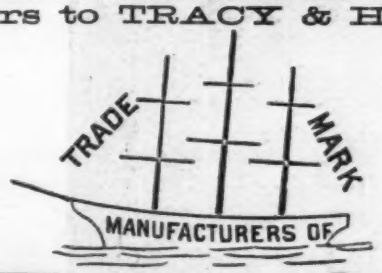

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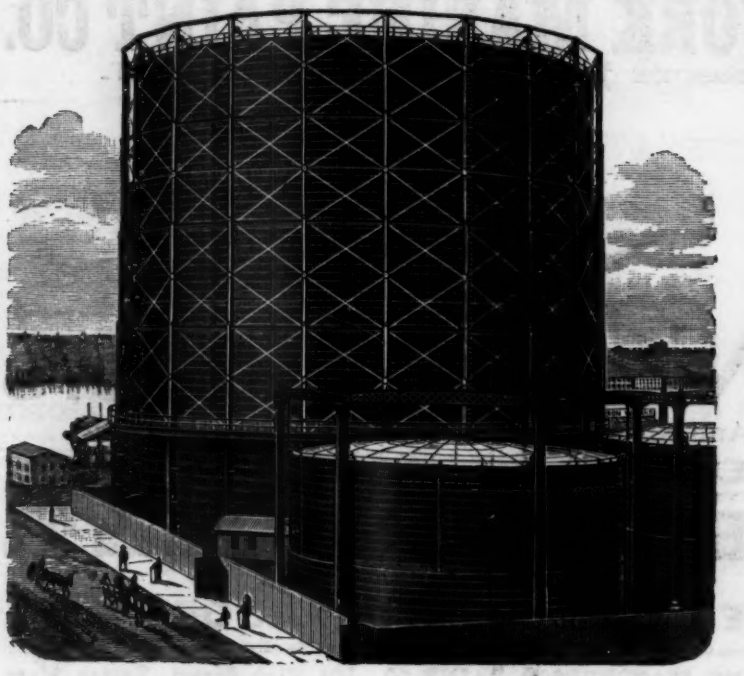

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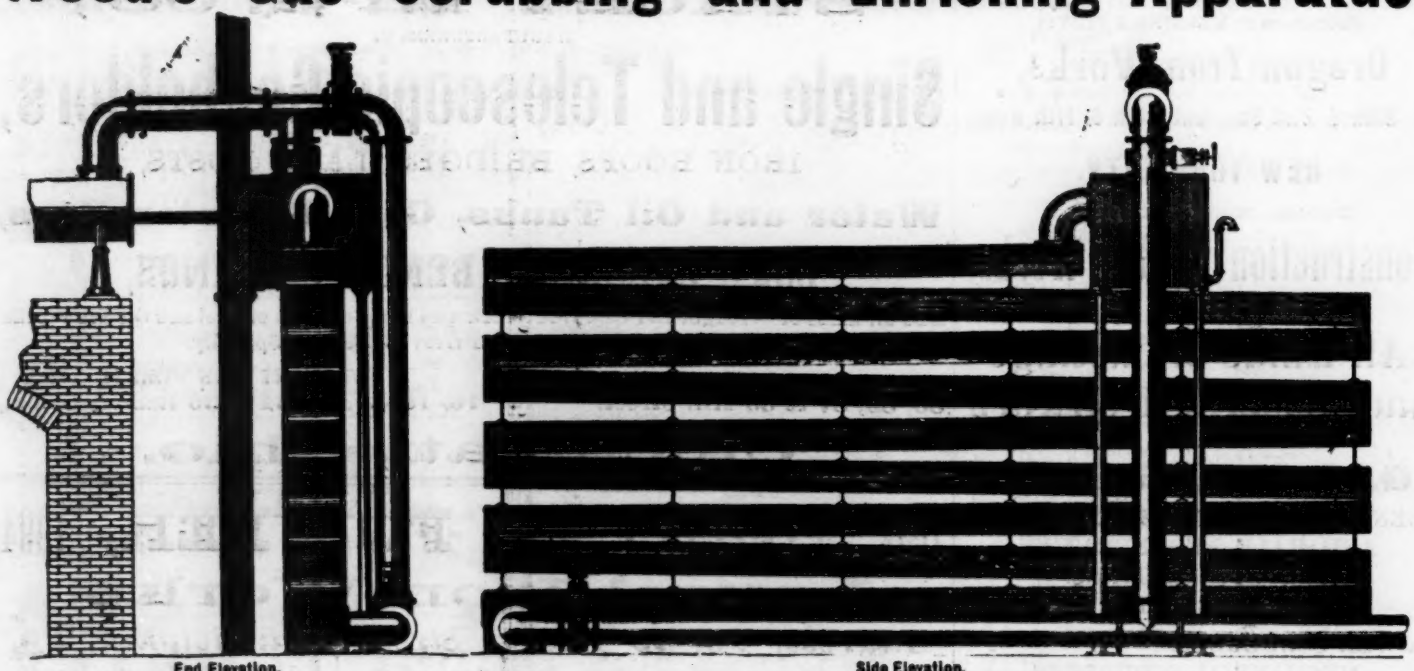

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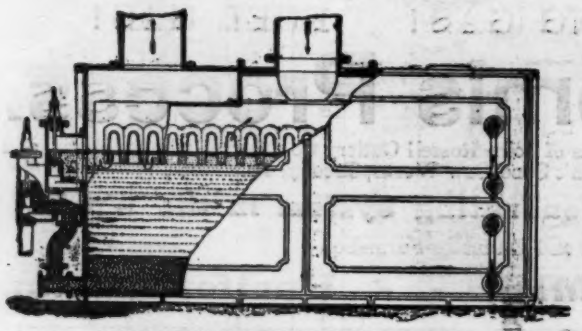

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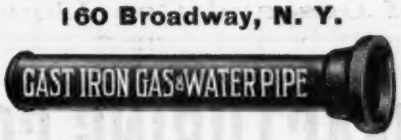

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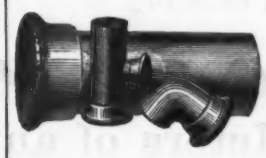

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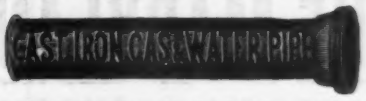

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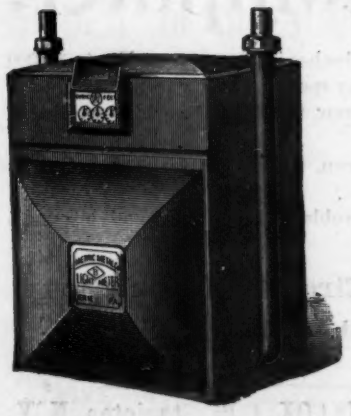

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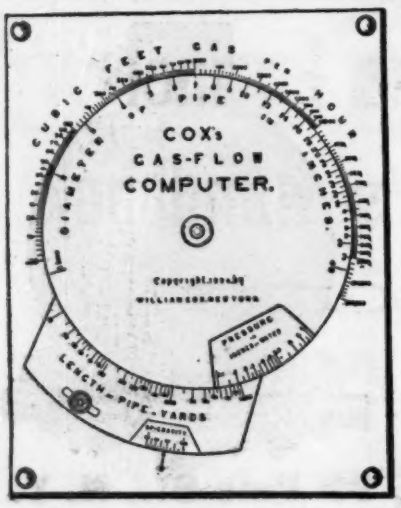

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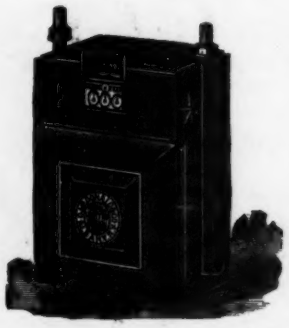

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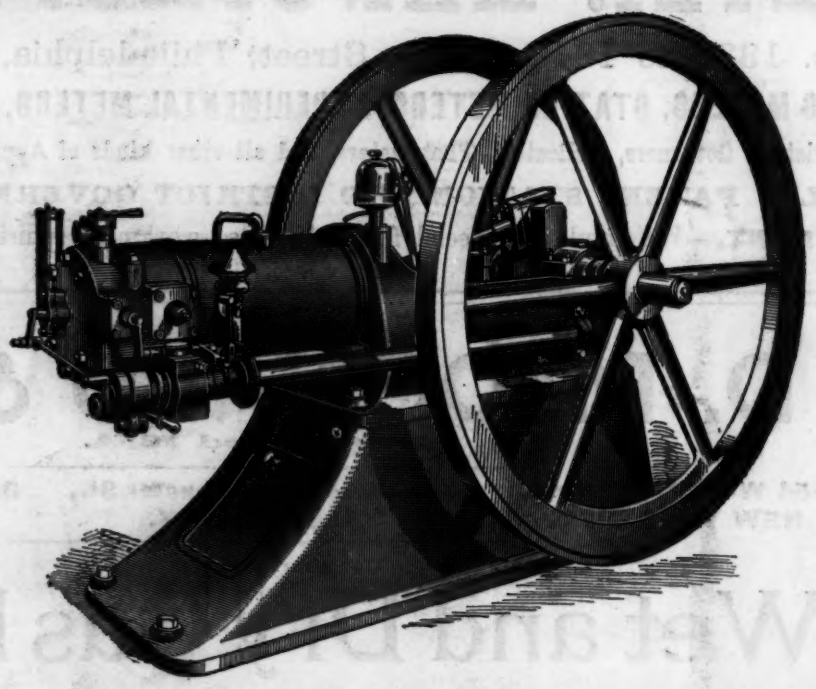

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